Multi-Level Governance, Climate Change Adaptation, and Agri-Environmental Stewardship in Small States

Micro-level Behaviour of Actors and Macro-level Policy Results

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UNIVERSITY OF TWENTE

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Colophon

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List of Acronyms

AES: Agri-Environmental Scheme
AIS: Agricultural Incentive Scheme
AOSIS: Alliance of Small Island States
BREA: Barbados Renewable Energy Association
CAP: Common Agricultural Policy
CARDI: Caribbean Agricultural Research & Development Institute
CARICOM: Caribbean Community
CBA: Community Based Adaptation
CBO: Community Based Organization
CC: Constituency Council
CCA: Climate Change Adaptation
CE: Choice Experiment
CERMES: Centre for Resource Management and Environmental Studies
CFAM: Caribbean Farmers' Network
CIT: Contextual Interaction Theory
COTED: Council for Trade and Economic Development
CPDC: Caribbean Policy Development Centre
CSO: Civil Society Organization
CTA: Technical Centre for Agricultural and Rural Cooperation
CV: Compensating Variation
CV: Contingent Valuation
CWA: Caribbean Week of Agriculture
DEFRA: Department for Environment, Food and Rural Affairs
ES: Environmental Stewardship
ESA: Environmentally Sensitive Area
EU: European Commission
FAO: Food & Agriculture Organization
GDP: Gross Domestic Product
GED: Government Electrical Department
GEF SGP: Global Environment Facility Small Grants Programme
GOB: Government of Barbados
GRO: Grassroots Organization
IDB: Inter-American Development Bank
IICA: Inter-American Institute for Cooperation on Agriculture
INRM: Integrated Natural Resource Management
IPCC: Intergovernmental Panel on Climate Change
MLG: Multi-Level Governance
NAP: National Adaptation Plan
NDC: Nationally Determined Contribution
NGO: Non-Governmental Organization
OECD: Organisation for Economic Co-operation and Development
OECS: Organization of Eastern Caribbean States
OLS: Ordinary Least Squares
REP: Rural Environment Protection

SDG: Sustainable Development Goal
SIDS: Small Island Developing State
TMAC: Technical Management Advisory Committee
UCLA: University of California Los Angeles
UN DESA: United Nations Department of Economic and Social Affairs
UNCED: UN Conference on Environment and Development
UNDP: United Nations Development Programme
UNEP: United Nations Environmental Programme
UNFCCC: United Nations Framework Convention on Climate Change
UNICEF: The United Nations Children's Fund
VCE: Virtual Choice Experiment
VCE: Virtual Choice Experiment
VIF: Variance Inflation Factor
VR: Virtual Reality
VRA: Vulnerability Reduction Assessment
VRCE: Virtual Reality Choice Experiment
WTA: Willingness To Accept
WTP: Willingness To Pay

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1. CHAPTER ONE: INTRODUCTION

According to the Intergovernmental Panel on Climate Change IPCC (2018), global climate has changed relative to the pre-industrial period, and there are multiple lines of evidence that these changes have had impacts on organisms and ecosystems, as well as on human systems and well-being. Climate Change is an existential threat to life on earth as we know it. This issue is far reaching, from the shifting weather patterns that threaten food production, to rising sea levels that increase the risk of catastrophic flooding, the impacts of climate change are global in scope, unprecedented in scale and driven by human activities (IPCC, 2018). Small Island Developing States (SIDS) are a subset of small states that are disproportionately impacted by climate change due to their inherent fragility including small but growing populations, limited resources, remoteness, susceptibility to natural disasters, vulnerability to external shocks, excessive dependence on international trade, and fragile environments (UN, 1992). The unique challenges facing SIDS that threaten sustainable development were first formally recognized by the international community at the UN Conference on Environment and Development (UNCED) in 1992 (Economic and Affairs, 2010). These challenges impact the ability of SIDS to appropriately implement climate change adaptation and environmental stewardship policy. This thesis seeks to explore, understand, and explain how macro-level climate change adaptation and environmental stewardship policy results emerge from the micro level behaviour of actors within the context of Multi-level Governance. The information derived from this research is aimed at facilitating improved climate change adaptation and environmental stewardship policy formulation and implementation, within the agricultural sector of SIDS with multi-level governance structures; by understanding, explaining and simulating the relationship between micro-level behaviour of actors and macro-level policy.

1.1 Multilevel Governance

Multi-Level Governance provides a framework to analyse the internationalization of climate change adaptation and agri-environmental policy, its impact on the role, power, and authority of sovereign Small Island Developing States. Multi-level governance was first conceptualized by and cemented by the seminal work of by Marks (1992). Marks suggested that MLG is a useful theory to understand and analyse the dynamics of decision making within the European Union. Schmitter (2004) considered MLG as an arrangement for making binding decisions that engages a multiplicity of politically independent but otherwise interdependent actors – private and public – at different levels of territorial aggregation in more-or-less continuous negotiation/deliberation/implementation, and that does not assign exclusive policy competence or assert a stable hierarchy of political authority to any of these levels. Bache (2005) referred to Multilevel Governance as a system of continuous negotiation among nested governments at several territorial tiers and described how supranational, national, regional, and local governments are enmeshed in territorially overarching policy networks.

Marks and colleagues (1996) differentiated MLG from Putnam's (1988) (liberal

intergovernmentalism showpiece) famous two-level theorization stating, “The point of departure for this multi-level governance is the existence of overlapping competencies among multiple levels of governments and the interaction of political actors across those levels. ... Instead of the two-level game assumptions adopted by state centrists, MLG theorists posit a set of overarching, multi-level policy networks. ... The presumption of multi-level governance is that these actors participate in diverse policy networks and this may involve sub-national actors – interest groups and subnational governments – dealing directly with supranational actors (Marks et al. (1996): 41-2).”

Notably, the substantial contributions and indisputable impact that non-governmental organizations made to daily politics of the European Union were highlighted by Marks et al. (1996) in a manner that ensured that this sector could not be ignored (Stephenson, 2013). Piattoni (2009) dramatically outlined the marauding of NGOs past the state-society gate. This demonstrates how strongly entangled this relation is and there is no reversal in view but rather an intensification. Piattoni further stated that, “The “actor-centredness” of MLG emphasized how the different levels were travelled and linked by actors moving rather freely across traditional levels and spheres of authority. The new processes were, therefore, not just *multi-level*, but also *multi-actor* – meaning that different types of actors linked different governmental levels and populated the policy networks thus formed.”

It is therefore not surprising that the theory focuses on the increased participation and interaction of non- state actors in governance and decentralization of the power from the central state. Piattoni (2009) acknowledges the complexity of the phenomena that is captured by MLG and the resulting difficulty of summarizing the phenomena observed through the lens of MLG into a single definition. Stephenson (2013) in his assessment of twenty years of MLG since the theory was first posited by Marks, concluded that it gave scholars a simplified way of understanding what European policy-making resembled on a day-to-day basis in certain policy areas, were we to slice the EU down the middle to obtain a cross-section of governance activity. This was done parsimoniously, in a manner that overcame complexity while allowing for detail analysis of how governance was arranged at the point of analysis without the need to precisely explain the dynamics of how governance arrangements had arisen (Kohler-Koch and Eising, 1999).

1.2 The Classification and Institutionalization of MLG

Stubbs (2005) noted that there are four main dimension to MLG that evolve around, “its broad appeal reflects a shared concern with increased complexity, proliferating jurisdictions, the rise of non-state actors, and the related challenges to state power” (Bache and Flinders, 2004). It is through these dimensions that the exploration of MLG can be thoroughly facilitated. These dimensions were further categorized by Stubbs as the increased role and participation of non-state actors, understanding decision making in terms of “complex overlapping networks” rather than “discrete territorial levels”, the multiple transformations in the role of the state, and challenging conventional notions of democratic accountability. Hooghe and Marks argue that MLG as characterized in the literature can be categorizes into two general types of MLG. These two types of MLG have been simply termed Type 1 and Type 2. Hooghe and Marks (2003) explain that Type I multi-level governance denotes general purpose jurisdictions at a limited number of levels while

Type II multi-level governance is distinctly different. It is composed of specialized jurisdictions. It is useful to note that multi-level governance arrangements can be measured according to their level of institutionalization (Hooghe and Marks, 2003). Roberge facilitated the categorization of MLG arrangements into weak, medium, and strong levels of institutionalization according to the levels of governance, division of policymaking powers and role of non-governmental actors.

The classification and institutionalization of MLG has been extensively studied in European governance and policy research (Stephenson, 2013). However, Mwangi and Wardell (2013) correctly states MLG no longer operates in splendid isolation as a three-layered, Eurocentric, isolated vision of policy-making, but acknowledges external actors in global governance (GG). This transformation in the application of MLG has fostered its use in the analysis governance outside of the European Union. Despite this additional MLG research is necessary to improve the understanding of the dynamic governance transformations outside of Europe and the accelerated pace of these changes (Mwangi and Wardell, 2013). The literature on the classification and institutionalization of MLG in African, Caribbean and Pacific Small Island Developing States remains relatively thin.

1.3 MLG Climate Change Adaptation and agri-environmental stewardship policy

Climate change adaptation and Agri-environmental stewardship has multi-level implications and therefore is best addressed using a multi-level approach. Granberg and colleagues (2019) agreed with Lovcraft (2008) in stating that social and ecological systems are intertwined, and human activities have rapidly altered ecological systems and their ability to sustain human societies. This is evident on a global scale with reference to the anthropogenic factors as drivers of climate change and its resulting impacts. With specific reference to climate change adaptation, it has become increasingly clear that municipalities and other local institutions can play a critical role (Agrawal and Perrin, 2009). This role at the local level with reference to adaptation has been increasingly placed under the microscope in the research and policy arena due to the justifiable and subsequently well-established idea that adaptation is best leveraged at the local scale since climate change impacts are primarily experienced locally, locally-driven action is key (Agrawal and Perrin, 2009; Baker et al., 2012; Agrawal et al., 2013).

A lack of coordination between national and local governance levels often reduces the effectiveness of multi-level governance climate policy processes (Schakel et al., 2015). This is a common outcome when national policy planners insufficiently consider local capacities for implementing climate change adaptation measures (Williams et al., 2020). Leck and Simon (2013) argue that that effective multi-level governance for climate change adaptation necessitates close collaboration and co-operation between these political scales. Pasquini and colleagues (2015) state that local governance shoulders the burden of action, this position is supported in the literature. Local governance is tasked with a broad range of responsibilities including but not limited to incorporating climate risks in development plans; mobilizing resources for adaptation; adjusting building and land use regulations to consider climate risks; and enhancing disaster preparedness, response and recovery (Corfee-Morlot et al., 2011; Reisinger et al., 2011; Baker et al., 2012). It is important to note that though local governance is situated at the base of the multi-level

governance hierarchy and constrained by resource limitations, it is complex and diffused (Williams et al., 2020). Concomitantly, local governance is deemed an essential entity in multi-level governance for implementing climate change adaptation measures (Williams et al., 2020).

The political and institutional processes through which decisions are taken and implemented in a specific sub-national geographic region “local governance” (Cities and Governments, 2019), is reflected in the National Adaptation Plans (NAPs) adopted under the United Nations Framework Convention on Climate Change (UNFCCC), in which greater consideration of local actors as implementers of climate change adaptation is strongly recommended (Di Gregorio et al., 2019) and accommodated to some degree in most national adaptation plans. However, one must be cognizant that the complexities of socioecological systems and their unpredictable interactions with climate change demand coordinated action at a system scale (Granberg et al., 2019). Multiple relevant systems can be identified, with varying scope and boundaries. With reference to climate change there are global climate systems, international systems of diplomacy and cooperation, national policy frameworks, regional action, local action and initiatives in combined top-down and bottom-up approaches (Sovacool et al., 2017; Moloney et al., 2018). There is consensus in the literature that given the complexity of this context, it is important that there is congruity between the scale of the problem and the level where measures are taken and the actors assigned (Marshall, 2015; Sovacool et al., 2017; Garrick, 2018). Moloney and colleagues (2018) show this idea has also become institutionalized and expressed in formal governance structures and policy processes. In keeping with this progressive institutionalization of climate change adaptation, Gonzales-Iwanciw and colleagues (2020) noted that the governance of adaptation to climate change has become a truly multi-level governance affair since the adoption of the Paris Agreement on Climate Change in 2015. He noted that with the adoption of the United Nations Convention on Climate Change (UNFCCC) in 1992 the global climate regime did not pay adequate attention to adaptation and therefore the Paris Agreement addressed this disparity between mitigation and adaptation.

Tensions between agricultural policies and the core principles of environmental sustainability have increasingly been placed under the spotlight due to the intensification of global environmental crises (Garnett et al., 2013; Rööß et al., 2017), climate change being one of the most overarching global crises. It must be noted that there are several case studies in Europe that have proven some schemes to be ineffective due to poor targeting and design (Boatman et al., 2008). Despite its shortcomings, the Common Agricultural Policy has played a key role in efforts to reconcile agricultural and environmental tensions, with agri-environment schemes emerging as a key policy device (Batáry et al., 2015; Zimmermann and Britz, 2016). The experience in Europe has demonstrated the AES can be effective in providing environmental benefits, but they must be appropriately designed and targeted as these schemes have proven expensive (Lane et al., 2003; Critchley et al., 2004; Boatman et al., 2008; Batáry et al., 2015). Beckmann and colleagues (2009) noted that while outcomes have varied, CAP regulations have continually encouraged EU Member States to design agri-environment schemes through “subnational, decentralised, and participatory” approach. The European Commission’s recent communication on the Future of Food and Farming draws attention to the need for subsidiarity and flexibility (Mottershead et al., 2018). This reflects an ongoing participative paradigmatic shift in public policy, which posits that by including a range of stakeholders from different interest groups and localities, these schemes would overcome resistance to change, increase their legitimacy, and meet the needs of diverse agricultural spaces (Newig and Fritsch, 2009; Brackenbury and Jones, 2015; Benoit and Patsias, 2017).

In response to this changing paradigm, emerging agri-environment scheme models seek to give locally affected stakeholders a greater role in designing and implementing locally adapted agri-environmental schemes (Department of Agriculture Food and the Marine, 2016; Westerink et al., 2017). Indeed, Beckmann et al. (2009) and Westerink et al. (2017) noted several instances where farmer participation in the governance and design of agri-environmental schemes has been shown as key to addressing landscape level environmental issues. However, other research has highlighted a need to move beyond participation and also address accountability and democratic deficits in multi-level governance as power is fragmented and fought for between various actors and levels (Kim and Schmitter, 2005; Harlow and Rawlings, 2007; Stephenson, 2013; Knox-Hayes and Hayes, 2014).

Despite the shifting paradigm, the existing literature shows that established actors are grappling to retain power in multi-level and participative governance processes (Armitage et al., 2007; Trouvé et al., 2007; Emery and Franks, 2012; Uthes and Matzdorf, 2013; Benoit and Patsias, 2017; Westerink et al., 2017). From Trouvé and colleagues (2007) to Benoit and Patsias (2017), they demonstrate how agricultural administrations and associations have retained powerful positions in CAP policy processes. On the flip side, Stephenson (2013) asserts, the instability of multi-level governance has provided actors with new opportunities to “increase their institutional and negotiating capacity” at various levels. It must be noted that except for Benoit and Patsias (2017) there are few studies of precisely how marginalised actors have gained influence within multi-level governance. McCarthy et al. (2018) recommends a shift toward agri-environment schemes that are designed and tailored to specific scales, phenomena, and localities. However, this does not improve accountability nor negate power struggles, exclusion or contestation.

Campbell et al. (2001) discuss the complexity of Integrated Natural Resource Management (INRM), a process that occurs at several scales involving multiple stakeholders, each with their own objectives and perceptions. They illustrate some of the challenges of MLG, which include the likelihood that interventions at one scale may have impacts at different (higher) scales and sometimes negative at one scale but positive at another. For example, soil and water conservation interventions may improve crop yields at a specific site but may show negative impacts at a larger scale by reducing water yields downstream. Similarly, small-scale extraction of groundwater resources may ultimately lead to depletion of the resource if too many boreholes are sunk. Another challenge concerns the appropriate level at which benefits are evaluated, which in turn depends on the types of impacts anticipated, objectives of assessments, the time scale used, the level of accuracy required, and the value system that is chosen by the evaluator (Campbell et al., 2001). The above demonstrates the need for country and context specific studies and the benefit of whole system simulation that is offered by micro and macro level simulation.

Di Gregorio et al. (2019) and McCarthy et al. (2018) suggest that research on multi-level governance (MLG) of climate change and agri-environmental stewardship policy respectively have increased in recent years, we do not understand well how power impacts the integration of policy decision-making processes across levels of governance (Doherty and Schroeder, 2011; Gupta, 2014; Marquardt, 2017). Di Gregorio et al (2019) noted that the MLG literature places particular focus on national-supranational relations, while national-subnational networking remains less explored (but see Jänicke and Quitzow (2017); Gomar et al. (2014)). The

predominantly global nature of climate change mitigation and contrasting local nature of climate change impacts and adaptation also pose specific MLG challenges for climate policy integration (Di Gregorio et al., 2019), particularly within the agricultural sector. It is surprising how cross-level interaction differs between the mitigation and adaptation sub-domains remains largely unexplored (Jordan et al., 2012; Locatelli et al., 2015; Di Gregorio et al., 2019). The literature reveals numerous studies that have looked at supranational MLG processes, such as environmental governance in the EU and at global-national linkages in climate change governance (Hooghe, 1996; Bache, 1998; Betsill and Rabe, 2009; Piattoni, 2009; Jordan et al., 2012). However, Di Gregorio et al. (2019) concludes that MLG of climate change faces distinct challenges in the Global South and remains an underexplored area (but see Bisaro et al. (2010) ; Fahey and Pralle (2016); Gallemore et al. (2015); Gruby and Basurto (2014); Gupta (2007); Jörgensen et al. (2015); Locatelli et al. (2017); Rantala et al. (2014); Ravikumar et al. (2015); Rosenau (2007); Sanders et al. (2017)).

1.4 GAPS in classification and institutionalization of MLG in SIDS with relevance to climate change adaptation and agri-environmental stewardship policy

The focus of the European MLG literature is on fundamental questions about the relationship of the EU level with lower-level actors, the governance structure, and the reasons why national governments diffuse power. Questions about local policy implementation, about the policy in the real world of action, are less often examined in the MLG literature (Kotzebue, 2012). Such applications MLG need to move beyond the EU into the global south (Di Gregorio et al., 2019). Several scholars argue that innovations in multi-level governance systems need to take the political setting of Small Islands States (SIS) inclusive of SIDS into account to create the means of identifying context-sensitive, bottom-up and community-led solutions producing equitable, efficient and effective outcomes (Adger et al., 2003; Sheng, 2009; Williams et al., 2020).

The literature on the classification, institutionalization and real-world policy implementation in SIDS is surprisingly rather thin. There are less than a handful of studies that address MLG in SIDS and include only a few published studies (see Fanning et al. (2007); Fanning et al. (2013); Williams et al. (2020)). One of these studies (Williams et al., 2020) focus on climate change adaptation but lacks a sectoral focus, the other two focus on marine environmental stewardship. However, these studies with reference to MLG were mainly descriptive of the levels and scales within the existing MLG framework but did not venture as far as to classify the type of MLG present or degree of institutionalization at the various levels.

In summary there is a huge gap in the literature within African, Caribbean and Pacific SIDS with reference to MLG. The scope of work is immense, firstly MLG dynamics within SIDS must be properly understood. This can only be achieved through appropriate classification and determining the degree of institutionalization with reference to the policies under examination. Secondly, the impact of the MLG types and level of institutionalization on real world policy implementation should be determined. Thirdly, country specific studies are inescapable, context specific recommendations to address imbalances in participation, accountability, capacity, and power at the relevant levels should be provided in a manner that could be easily utilized by policy makers. Finally, since climate change adaptation and agri-environmental stewardship generally occur at

the local level, emphasis should be placed on guiding the creation of bottom-up and community-led solutions producing equitable, efficient, and effective outcomes.

1.5 Research Questions

Overarching question:

What is the impact of MLG on climate change adaptation and environmental stewardship policy in SIDS?

Individual research questions:

1.0 How does MLG impact the climate change adaptation and environmental stewardship policy making process within the agricultural sector of a SIDS (Barbados)?

2.0 Who are the main actors who influence climate change adaptation and environmental stewardship policy formulation inside the existing tiers of MLG and how does the balance of power, cognition, motivation and accountability among the main actors impact the policy implementation process in a SIDS?

3.0 What role does agri-environmental policy factors such as spatial relevance, demographic and geographical specific payment strategies play in determining the agri-environmental stewardship behavioural choice process of actors and farmers?

3.1 What are the specific agri-environmental stewardship policy attributes and associated willingness-to-accept (WTA) that drive farm environmental stewardship and climate change adaptation behaviour?

4.0 What is the Willingness-To-Pay (WTP) to maintain the agricultural landscape of Barbados with improved agri-environmental services?

4.1 To what degree can farmers' WTA driven by the AES policy be supported by Taxpayers' WTA and how does this relate to MLG?

Table 1.1: Logic of Research Questions & Relationship to Current Research Field

Research Question	Theoretical and/or Empirical Relevance	Real World SIDS Policy Relevance	Logic using Fig 1.1 Schematic Correlated Letter(s)
1.0 How does MLG impact the climate change adaptation and environmental stewardship policy making process within the agricultural sector of a SIDS?	Within the MLG literature there are few studies that focus specifically on the presence of multi-level in SIDS and its impact on agri-environmental and climate change adaptation policy and implementation. In addition, the balance of actor characteristics that are required to successfully implement policies in SIDS will be quantitatively determined.	The answers to these questions provide policy makers within SIDS with a more explicit understanding of the MLG environment in which they operate and its impact on policy formulation and implementation.	Understanding how a & b impact the architecture of d.
2.0 Who are the main actors who influence climate change adaptation and environmental stewardship policy formulation inside the existing tiers of Multi-level Governance and how does the balance of power, cognition, motivation and accountability among the main actors impact the policy implementation process in a SIDS?			Identifying the main actors in a & b and how they impact on the implementation of d.
3.0 What role does agri-environmental policy factors such as spatial relevance, demographic and geographical specific payment strategies play in determining farmer participation in agri-environmental stewardship?	The role and impact of agri-environmental policy factors on increasing the probability of participation of different groups of farmers in agri-environmental schemes using CE have been largely unaddressed in the literature (Ruto & Garrod 2009).	The answers to these questions provide policy makers with a greater understanding of the micro-level behaviour of agents and how this behaviour could be influenced to improve the impact of policy.	Understanding how d impacts on e.
3.1 What are the specific agri-environmental			

stewardship policy attributes and associated WTA that drive farm environmental stewardship and climate change adaptation behaviour?			
4.0 What is the WTP to maintain the agricultural landscape of Barbados with improved agri-environmental services?	Further verification on the impact of virtual choice experiments conducted by Bateman and colleagues (2006) and its relationship with spatial relevance and interest of actors	This provides an acceptable payment vehicle and determines the WTP by the Barbadian public to finance the policy based on perceived benefits.	Understanding c & their 'attitudes' to d.
2-way feedback: Bottom up: 4.1 To what degree can farmers' WTA driven by the AES policy be supported by Taxpayers' WTA and how does this relate to MLG? Top-down:	AES Simulation based on WTA and WTP choice experiment results.	This allows for simulating of the relationship between micro-level behaviour of agents and macro-level policy results. This model will present policy makers with the possible outcome of policies before they are implemented.	F

FIGURE 1.1: SCHEMATIZED CONCEPTUAL MODEL

The arrows in Figure 1.1 represent the perceived direction of the interactions between actors at multiple levels within the conceptual model. These interactions will be explored when addressing the research questions.

1.7 Research Framework

MLG provides a fitting framework to analyse the internationalization of agri-environmental policy and its impact on the role, power, and authority of sovereign Small Island Developing States. Using the work of Hooghe and Marks (2003) the dominant MLG structure with regards to climate change adaptation and agri-environmental stewardship can be understood and classified to inform its role and impact on the relevant policies processes. The degree of institutionalization of MLG at the various levels will be categorized into weak, medium and strong levels of institutionalization according to the levels of governance, division of policymaking powers and role of non-governmental actors utilizing the approach taken by Roberge (2004).

Another important empirical focus of this study is on MLG and its impact on agri-environmental stewardship and climate change adaption within a SIDS. Case study analysis utilizing the Contextual Interaction Theory (Bressers, 2007) will be used to determine the type of MLG present, the main actors and the impact of MLG on the architecture of the agri-environmental stewardship policy. Contextual Interaction Theory (CIT) provides a vehicle for understanding MLG agri-environmental policy implementation (Bressers, 2007). CIT suggest that policy actors' motivation, information needs, and level of collaboration are key variables influencing policy and program implementation. Once the interaction between policy implementers and targets are well understood, quantitative modelling of CIT can be achieved, and the adequacy of policy implementation simulated.

Climate change adaption and environmental stewardship within the agricultural sector have traditionally fallen under the umbrella of Agri-environmental policy and a common mode of achieving these goals is the utilization of Agri-environmental Schemes (Latacz-Lohmann and Hodge, 2003; Pavlis et al., 2016; Vesterager et al., 2016). Agri-environmental schemes offer payments to farmers for effective land management to protect and enhance the environment and wildlife. Agri-environmental Schemes (AES) also have an overarching objective to improve climate change adaptation and mitigation (Keenleyside et al., 2011). Factors that influence participation behaviour in agri-environmental schemes for Europe and the USA have been extensively studied and documented in the literature (Morris and Potter, 1995; Wilson, 1997; Wilson and Hart, 2000; Wynn et al., 2001; Wossink and van Wenum, 2003). Siebert and colleagues in (2006), followed by Ahnström and colleagues in (2009) they provide an extensive review of such studies. Other studies focus on transaction cost (Falconer, 2000; Mettepenningen et al., 2009) and the role of information asymmetries for contract design of these schemes (Moxey et al., 1999; Ozanne et al., 2001). However, the role and impact of agri-environmental policy factors on increasing the probability of participation of different groups of farmers in agri-environmental schemes have been largely unaddressed in the literature (Ruto and Garrod, 2009). This study contributes the literature by assisting in filling the existing information gap and providing further verification on the use of virtual choice experiments conducted by Bateman and colleagues (2009).

This study utilizes choice experiments, spatial analysis and socio-demographic data conducted in Barbados to evaluate the premise that well designed geographically specific payment strategies for AES should lead to greater participation by farmers (Ruto and Garrod, 2009), thus resulting in improved environmental stewardship and climate change adaptation within the agricultural sector. The innovation in this design of the geographically specific payment strategies results from the ex-ante accommodation for the estimated percentage of high resistant adopters/farmers, farm demographics and the environmental issues within a specific geographical area. The study also investigates the dynamics of willingness-to-pay (WTP) and willingness-to-accept (WTA) for agri-environmental stewardship within a small island developing state (SIDS) utilizing Choice Experiments (CE).

Economic value can be measured by the amount of money an individual is willing to pay (WTP) for a good or service or conversely willing to accept (WTA) for providing a good or service (Van Beukering et al., 2007). Pearce (2002) in his history of environmental economics shows that environmental valuation was born out of welfare economics and Kreps (1990) demonstrates its roots in consumer demand theory. In 1974, Maler's through his classic treatise was able to weave

together the underlying theory of economic valuation. In addition, Maler was one of the pioneers that sought to develop the elicitation of the willingness to pay from the use of questionnaires which is now formally called in environmental valuation the stated preference method. Environmental valuation research preceding Maler's work mainly focused on revealed preferences utilizing mainly the travel cost and hedonic methods (Pearce, 2002). To arrive at WTP for a nonmarket environmental goods or services consumer demand theory is expanded to include environmental services as parametric arguments in the utility function. Perman and colleagues (2003) state, "Expressing the variation and surplus measures in terms of cost functions makes apparent their relationship to WTP and WTA, and hence the way that, in principle, a well-designed contingent valuation (CV) exercise would directly elicit these measures for individuals." Contingent valuation as we know it today has its roots in two recreational use studies conducted in 1958 (Mack and Myers, 1965) and 1961 (Davis, 1963) since then CV gained popularity and has subsequently been extensively applied to evaluate Agri-environmental policy. However, CV does not easily account for environmental attributes and attribute bundles. As a result, the use of choice experiments is rapidly becoming the valuation method of preference in this new millennia when addressing agri-environmental policy attributes.

A choice experiment is a quantitative stated preference method used to elicit individual preferences. Choice experiments facilitate the discovery of how individuals value selected attributes of a product, service or programme by asking them to state their choice over different hypothetical alternatives (Mangham et al., 2009). This stated preference method is derived from the Lancaster's theory of consumer choice (Lancaster, 1966) and random utility theory (Ben-Akiva and Lerman, 2018). Nonmarket goods are valued in terms of their attributes and levels of attributes, and respondents are asked to make choices between different attribute bundles. An innovation in choice experiments demonstrated that attributes can be defined in terms of various aspects of environmental policy design (Hanley et al., 2003). This, therefore, facilitates the utilization of choice experiments to determine the attributes of agri-environmental policy that would increase the probability of participation by certain groups of farmers and taxpayers who could potentially finance the relevant policy.

1.8 Chapter Content & Structure

Chapter 2: Multi-level Governance in SIDS: Tracking down an escaped concept and its impact on Climate Change Adaptation and Agri-environmental Policy

Multilevel Governance is a system of continuous negotiation among nested governments at several territorial tiers and describes how supranational, national, regional, and local governments are enmeshed in territorially overarching policy networks. This type of governance system is extensively examined in European studies but attention on this matter within SIDS has been limited. This chapter will examine its presence and impact on climate change adaptation and agri-environmental policy within SIDS utilizing the case of Barbados. This examination will be achieved by firstly identifying and describing the governance structures and policies that exist at the various levels of governance present in the Climate Change Policy arena with reference to the agricultural sector. Following this, these structures will be classified and the arrangement of relations within this arena as it pertains to the various levels and scales of agricultural climate

change adaptation policy will be explained. The chapter will conclude by identifying the specific type of MLG presence, summarizing the resulting impacts within the specific policy arena of interest, and providing relevant policy recommendations.

Chapter 3: A Multi-Level Governance Approach: Changing Environmental Policy Implementation from the Bottom-Up

Climate change adaptation policy implementation occurs at multiple levels within the MLG structure and often involves actors at various levels within the same policy implementation process. Often a top down approach to policy implementation within the MLG structure is taken. This chapter seeks to explain whether improved adequacy of climate change policy implementation can be facilitated in the presence of MLG if the main actors, especially at the local level, possess or are empowered with the appropriate balance of motivation, cognition and power and are held accountable for their actions. This facilitated through the lens of contextual interaction theory as a framework for the evaluation of climate change adaptation policy implementation. Firstly, the main elements of CIT are outlined and later through the translation of the theory into an empirical model, it is then utilized to address the question at hand. A case study approach is applied to climate change adaptation projects in Caribbean, African and Pacific SIDS implemented by the Global Environment Facility Small Grants Programme. Case selection criteria are developed, and 19 cases drawn from the three geographical areas selected. The questionnaire applied by Owens (1998) in the first attempt to create an empirical model for CIT has been slightly modified, adjusting for the shortcomings identified in the first empirical study and widening its application to model climate change adaptation implementation. The results of the interviews then undergo quantitative analysis and the chapter concludes by providing implementation recommendations that can improve the adequacy of climate change adaptation policy implementation at the local level.

Chapter 4: Improving agri-environmental stewardship and climate change adaptation in SIDS through flexible monetary incentives driven by demographic and geographical factors

As a part of Government of Barbados policy to improve climate change adaptation, agri-environmental stewardship and move towards a resource-efficient green economy, the government has introduced several fiscal incentives targeted at farmers in 2008. The incentives are underutilized by farmers, and the level of environmental stewardship and climate change adaptation within the agricultural sector in Barbados remains low. This chapter will utilize choice experiments (CE), spatial analysis and socioeconomic data to evaluate the premise that well designed geographically specific payment strategies within the context of an Agri-environmental Scheme will improve adaptation and agri-environmental stewardship among farmers. The chapter proceeds with a brief review of relevant agri-environmental Schemes and the relationship with climate change adaptation is established. Subsequently, a description of the case study area, its main characteristics and the existing agricultural incentive scheme will be provided. Then the CE theoretical framework will subsequently be elaborated and the associated methodology for its design, implementation and analysis are outlined. Following this the results of the CE will be analysed and discussed in a manner that facilitates the distillation of policy implications relevant to SIDS in the conclusion of the chapter.

Chapter 5: Maintaining a traditional agricultural landscape in a Small Island Developing State with improved Climate Resilience & Agri-Environmental Services

This chapter will seek to determine the role and impact of agri-environmental policy attributes on WTP and adoption rates in order to facilitate a well-informed policy decision on the implementation of an AES in a manner that would maintain the traditional agricultural landscape, improve agri-environmental stewardship and climate change adaptation within the small island developing state Barbados. An AES of this nature could potentially reduce direct transfers to the agricultural sector, create fiscal space through a sustainable financing mechanism and contribute to the Nationally Determined Contributions to the UNFCCC. The chapter will begin with brief review of relevant Agri-environmental Schemes and WTP Studies previously undertaken. Subsequently, a description of the case study area and its main characteristics will be provided. Then the VCE theoretical framework is elaborated and the associated methodology for its design, implementation and analysis are outlined. Following this the results of the VCE will be analysed and discussed in manner that facilitates the distillation of policy implications in the conclusion of the research findings.

Chapter 6: Conclusion

This concluding chapter is framed by the main research questions which are succinctly addressed. The chapter will clearly outline the key policy implications and recommendations emanating from this body of work. The innovations, strengths and limitations are presented in a manner that facilitate an appreciation for the context of this work while concomitantly illuminating the scope for improvement and further work. Pragmatic recommendations are made based on the opportunities that became evident during this study.

1.9 Case Study Areas

These issues and dynamics are examined within the central chapters of this thesis, using Barbados as the main case study and a prime example of MLG dynamics within SIDS. In addition, 19 cases were randomly selected from Caribbean, African and Pacific SIDS. Countries included from these three geographical regions include: Antigua, Barbados, Belize, Cap Verde, Cuba, Dominica, East Timor, Jamaica, Haiti, Kiribati, Papua New Guinea, Samoa, Seychelles, St. Kitts, St. Kitts, St. Lucia, and Trinidad.

Barbados has been chosen as the main country of study because it is classified as a SIDS and as part of its current quest to develop the green economy it is seeking to facilitate improved climate change adaptation and environmental stewardship within the agricultural sector. Barbados is situated in the western area of the North Atlantic, 100 kilometres east of the Windward Islands and the Caribbean Sea. It has a total land area of 431 km² and in 2011 the population size was estimated at 273,900 (World Bank, 2012). Population has been growing at an annual percentage rate of 0.1 (World Bank, 2018) and is ranked 56th on the Human Development Index (UNDP, 2019). In the last five years the GDP growth has fluctuated with positive and negative annual percentages. The

main foreign exchange earner is tourism.

As a part of Government of Barbados policy to improve climate change adaptation, agri-environmental stewardship and move towards a resource efficient green economy, the Ministry of Agriculture has introduced several fiscal incentives targeted at farmers. These incentives are equally provided to all registered farmers who adhere to the rules and regulations of the incentive programme. The fiscal instruments and policies have not been effective in achieving the desired change within the agricultural sector. The incentives are underutilized by farmers and the level of environmental stewardship and climate change adaption within the agricultural sector in Barbados remains low. The problems in this sector, that directly relate to the issues outlined have been broadly ascribed to the governance of the sector which has significant implications on the implementation of policies and the structure of the agricultural incentive programme (Agricultural Planning Unit 2012).

2. CHAPTER TWO: MULTI-LEVEL-GOVERNANCE IN SIDS: TRACKING DOWN AN ESCAPED CONCEPT AND ITS IMPACT ON CLIMATE CHANGE ADAPTATION POLICY

2.1 Introduction & Background

The study of Multi-level governance (MLG) has been largely confined to the European Union and its origins within European Studies. MLG was first conceptualized by and branded by the seminal work of Gary Marks (1992). Marks suggested that MLG is a useful theory to understand and analyse the dynamics of decision making within the European Union. In the last decade scholars have started to explore its presence and impact in Canada, USA, and parts of Latin America. However, there is a stark absence in the literature concerning the presence and architecture of MLG in Small Island Developing States (SIDS) and its resulting impact on public policy. The rapid spread of MLG beyond its traditional borders of study should not be ignored but rather it should be evaluated and explored on a contextual basis. The concept and intentional or unintentional practice of MLG has escaped the borders of Europe, cultivating itself in SIDS and is having a noticeable impact on climate change and environmental stewardship policy formulation. This paper seeks to explore the presence of MLG in SIDS and its impact on climate change adaptation policy within the agricultural sector. It addresses the following questions: 1) To what extent and what kind of MLG is present? 2) What are the effects of MLG on adaptation policy in the agrarian sector in a specific SIDS?

In this paper it is hypothesized that MLG is present and can be identified in SIDS to varying degrees. In addition, it is further hypothesized that MLG has been institutionalized within the context of agricultural climate change policy. To explore the dimensions of these hypotheses, Barbados for the purpose of this research paper was selected based on the lead role that it has played in international environmental governance and as a representative sample of Caribbean SIDS. SIDS are described by the United Nations as “low-lying coastal countries that tend to share similar sustainable development challenges, including small but growing populations, limited resources, remoteness, susceptibility to natural disasters, vulnerability to external shocks, excessive dependence on international trade, and fragile environments (UN, 1992). To facilitate this investigation, it is necessary to identify and describe the governance structures and policies that exist at the various levels of governance present in the Climate Change Policy arena. It also becomes relevant to classify these structures and explain the arrangement of relations within this arena as it pertains to the various levels and scales of agricultural climate change adaptation policy. This allows for the presence of MLG to be traced, classified and its impacts identified within the specific policy arena of interest.

2.2 Methodology & Theoretical Frame

This analysis proceeds in the following manner. The governance structures and climate change policies relevant to this analysis at the local, national, regional, and international level are systematically described. This description of the governance structures at the various levels and the dispersion of authority across levels are then utilized to determine the type of MLG present as categorized by Hooghe and Marks (2003). Following this, the governance structures and their role in climate change policy formulation and implementation will be utilized to determine the level of MLG institutionalization as it relates to agricultural climate change policy (Roberge, 2004).

MLG provides a framework to analyse the internationalization of agri-environmental policy and its impact on the role, power, and authority of sovereign Small Island Developing States. MLG was first conceptualized by and cemented by the seminal work of by Marks (1992). Bache (2005) referred to MLG as a system of continuous negotiation among nested governments at several territorial tiers and described how supranational, national, regional, and local governments are enmeshed in territorially overarching policy networks. The theory focuses on the increased participation and interaction of non- state actors in governance and decentralization of the power from the central state. Given the dynamics of MLG, Oberthür and Gehring (2006) stated that the effectiveness of environmental governance instruments, such as international regimes environmental instruments, is affected by inter-institutional influence from other regimes/policy instruments. This is inclusive of agri-environmental climate policy.

To measure the formal dispersal of authority from the central/nation state within the MLG structure both up to supranational and down to subnational governance structures the following independent variables will be used and the associated coding scheme from Hooghe and colleagues (2010): institutional depth, policy scope, fiscal autonomy, representation, law making, executive control, fiscal control and constitutional reform. Hooghe and colleagues have only applied this methodology below the state. However, for the purpose of this research the methodology will be applied both below and above the state. These independent variables are described in the Table 2.1. Please see Appendix A for the scoring methodology.

Table 2.1: Measurement Instruments of Authority Above or Below the State

Authority Above or Below the State (0-24):	Sum of Authority Measurement Instruments
<ul style="list-style-type: none"> • Institutional depth (0-3): 	extent to which a local, regional or international government/governance structure is autonomous rather than deconcentrated.
<ul style="list-style-type: none"> • Policy scope (0-4): 	Range of policies for which a a local, regional or international government/governance structure is responsible.
<ul style="list-style-type: none"> • Fiscal autonomy (0-4): 	Extent to which a local, regional or international government/governance structur can independently tax its population.
<ul style="list-style-type: none"> • Representation (0-4): 	Extent to which a local, regional or international government/governance structure is endowed with an independent legislature and excutive.
<ul style="list-style-type: none"> • Law making (0-2): 	Extent to which local, regional or international government/governance representatives co-determine national legislation.
<ul style="list-style-type: none"> • Executive control (0-2): 	Extent to which a local, regional or international government/governance structure co-determines national policy intergovernmental meetings.
<ul style="list-style-type: none"> • Fiscal control (0-2): 	Extent to which a local, regional or international government/governance structure representatives co-determines the distribution of national tax revenues.
<ul style="list-style-type: none"> • Constitutional reform (0-2): 	Extent to which a local, regional or international government/governance structure regional representatives co-determine constitutional change.

Adapted from the regional assessment instruments (Hooghe et al., 2010).

Hooghe and Marks (2003) argue that MLG as characterized in the literature can be categorized into two general types of MLG. These two types of MLG have been simply termed Type 1 and Type 2 and are outlined in the table below.

TABLE 2.2: Types of Multi-Level Governance

Type 1	Type 2
General-purpose	Task-specific Jurisdictions
Non-intersecting membership	Intersecting memberships
Jurisdictions organized in a limited number of levels	No limit to the number of jurisdictional levels
System-wide architecture	Flexible design

(Source: Hooghe and Marks 2003)

Hooghe and Marks (2003) explain that Type I multi-level governance denotes general purpose jurisdictions at a limited number of levels. They define general purpose jurisdictions as jurisdictions that, “bundle together multiple functions, including a range of policy responsibilities, and in many cases, a court system and representative institutions.” The membership boundaries of such jurisdictions do not intersect. This is the case for jurisdictions at any one level, and it is the case for jurisdictions across levels. In Type I governance, every citizen is located in a Russian Doll set of nested jurisdictions, where there is one and only one relevant jurisdiction at any particular territorial scale. Territorial jurisdictions are intended to be, and usually are stable for periods of several decades or more, though the allocation of policy competencies across jurisdictional levels is flexible.

Type II governance is distinctly different. It is composed of specialized jurisdictions. Type II governance is fragmented into functionally specific pieces – such as, providing a particular local service, solving a particular common resource problem, selecting a particular software standard, monitoring water quality of a particular river, or adjudicating international trade disputes. The number of such jurisdictions is potentially huge, and the scales at which they operate vary widely. There is no great fixity in their existence. They tend to be lean and flexible – they come and go as demands for governance change.

Roberge (2004) operationalized the concept of MLG by measuring the MLG arrangements according to their level of institutionalization within a specific policy sector. This facilitated the categorization of MLG arrangements into weak, medium, and strong levels of institutionalization of which the differences are highlighted in the table below.

TABLE 2.3: Operationalization of Multi-Level Governance

	Levels of Governance	Division of Policymaking Powers	Role of Governance
Weak	2 Levels of Authority	No Duplication or Overlap	- Point of Entry Limited to One Level of Authority - Limited Policymaking Role

Medium	More than 2 Level of Authority (Possible Participation of Either Regional or International Levels of Governance)	Possible Duplication and Overlap	- Point of Entry Across Levels of Authority - Increased Policymaking Role
Strong	More than 2 Level of Authority (Definite Participation of Either Regional or International Levels of Governance)	Institutionalized and Routinized, Possible Duplication and overlap	- Point of Entry Across Levels of Authority - Increased Policymaking Role

Where the level of institutionalization is weak, interaction is restricted between two levels of authority. The role of these levels are clearly delineated and the involvement of private regimes are less present in the governance arrangements. Roberge (2004) states that, this type is consistent with federal systems in many ways. In the presence of a medium system of multi-level governance the sole interaction between two levels of authority is broken with the possible inclusion of either a regional or international level of governance. As a result of this perturbation to the system a redistribution of jurisdictional authority occurs. This leads to the delineation of powers being unclear and the potential for duplication and overlap.

When the level of institutionalization is strong, there is a noticeable increase in the role and number of non-governmental organizations in governance arrangements in contrast to when the level of institutionalization is weak. Roberge (2004) notes that a rise in the MLG arrangement should lead to both a greater policy advocacy and policy participation role for these actors. Problems and solutions tend to follow a general trend of becoming broader in scope as the internationalization of public policy occurs. The resulting consequences policy change impacts a larger number of actors involved in the enlarged policy arena. Roberge predicts that as the policy broadens, these actors seek to involve themselves more and more in the policy process.

A strong system of multi-level governance is characterized by more than two levels of authority with the possibility of the existence of four or five levels of authority. The number of levels is not only open to potential increases, but the institutionalization of these levels also becomes noticeably more substantial, characterized by authority that is more formalized and increasingly customary. The capacity of these levels to formulate and implement policies is more elaborate. The regional and international levels of governance have the resources and the know-how to fully exercise their authority. Though duplication and overlap are still likely to exist in a strong system of multi-level governance, the jurisdictional authority of each level is refined. Either through some form of treaty or constitutional agreement, or through norms in use, there is a clarification of the role and power of each level of authority. That being said, international events could outpace institutionalization ensuring continual jurisdictional conflicts across levels of authority. Third, the role of non-governmental actors in governance is here again to increase.

2.3 The Presence of MLG in SIDS: Looking from the Bottom Up

In the search to uncover the presence of MLG within SIDS, the factors previously discussed such as the dispersion of power and authority, the level of institutionalization, specificity of jurisdictions, membership interaction, and flexibility of the governance architecture are fundamental tools to facilitate the identification of MLG within SIDS. To ensure effectiveness, these tools must be applied to the appropriate governance and policy framework. Multilevel governance is often manifested in a combination of top down and bottom up approaches to governance. Utilizing the conceptual representation below (Figure 2.1) of the local, national, regional, and international governance and policy dynamics, the search will be initiated from the bottom-up.

FIGURE 2.1: BARBADOS CLIMATE CHANGE GOVERNANCE & POLICY UNDER THE LENS OF MULTI-LEVEL GOVERNANCE

Given the sheer scale and complexity of climate change governance it is impossible in the context of this paper to explore all of the structures at the international and regional level. As a result,

Figure 2.1 above and Table 2.4 below focus on the governance structures critical to this analysis. Multilevel governance is often manifested in a combination of top down and bottom up approaches to governance. Therefore, the current measured formal dispersal of authority across levels in Table 2.4 beginning at the local level below the state and the regional and international levels above the state becomes relevant for assessing the structure and organization MLG from the bottom up.

Table 2.4: Measuring the dispersal of authority across levels.

Authority Measurements	Local	Regional/CARICOM	International/UN
Institutional depth (0-3)	0	1	2
Policy Scope (0-4)	0	4	3
Fiscal autonomy (0-4)	0	0	0
Borrowing (0-3)	0	0	0
Representation (0-4)	0	1	1
Law making (0-2)	0	1	1
Executive control (0-2)	0	2	1
Fiscal control (0-2)	0	0	0
Constitutional reform (0-3)	0	0	0
Self-rule	0	-	-
Shared-rule	0	-	-

The results in this table will be referenced when examining the governance structures across levels.

2.4 Local Governance Structure

Though Barbados is a parliamentary democracy, the local government is not elected; the system of elected local government was initiated in 1639 by the British and dissolved in 1966 when Barbados became independent. However, the Constituency Council Act of 2009 created a Department of Constituency Empowerment (DCE) within the Ministry of Social Care, Constituency Empowerment and Community Development which was tasked with the creation of constituency councils within the 30 constituencies of Barbados (Pounder, 2015). The Constituency Council is defined as ‘a legally established body of local representatives, who have been appointed and given the authority to voice the concerns of the various residents of the constituency’ and its role as ‘to maintain links with the Government and its agencies; and to effectively and efficiently assist in the management of resources assigned for the development of the given constituency.’ There are no organized country-wide associations of local government in Barbados.

The law requires that each CC hold biannual public meetings to update local residents on the progress and agenda of the CC for the prescribed period. The Constituency Council Act 2009 requires CCs to build databases of their constituency in collaboration with government departments and to identify the priority needs of their constituency based on supporting data.

The Act invites the public to submit requests to the CCs outlining their specific needs and these must be discussed at CC meetings and formally reported on. The councils have no authority to raise revenue and each constituency only receives a grant of US \$ 50, 000.00 per year. Each council only has one staff member provided and paid for by central government.

With reference to Table 4, when self-rule and shared rule is taken into account the councils lack institutional depth, policy scope, fiscal autonomy, borrowing powers, representation, law making, executive control, fiscal control and the ability to contribute to constitutional reform. In this regard the power and authority of local government in Barbados is relatively weak. In addition, its role as a legitimate layer of government separate and distinct from national government is questionable as all of its revenue and staff are derived from government.

2.4.1 Civil Society

Barbados has several CSOs that are issue based or traditional like the Rotary clubs, Scouts groups and various cultural groups. There are also a few environmental groups such as the Barbados Marine Trust, the Barbados Environmental Society, the Barbados National Trust, the Barbados Institute of Environmental Professionals, and the Barbados Environmental Youth Programme which is affiliated to the Caribbean Environmental Youth Programme. Most of these groups however do not have a vibrant grassroots membership to facilitate strong advocacy. Some CSOs also receive subventions from Government which could have some influence on their level of representation of issues. Civil Society Organizations within the agricultural sector such as the Barbados Agricultural Society and the farmer organizations under its umbrella have a significant impact on national agricultural policy and indirectly on regional agricultural policy through its affiliation and active participation in the Caribbean Farmers' Network (CFAN).

2.4.2 Barbados National Governance Structure

Barbados has a bicameral legislature with a Lower House of Assembly which is due for reelection every five years at the General Elections and an appointed Upper House or the Senate. The island is divided into thirty constituencies. At a General Election, the representatives from each constituency are voted for by their constituents. The party winning the most seats in the House of Assembly will then become the leading party. The country is well known for its political stability and boasts one of the oldest houses of parliament in the British Commonwealth which dates to the 1630s. Her Majesty the Queen of England and Head of the British Commonwealth is the Head of Parliament and she is represented by the Governor General. The Prime Minister is the Executive Head of Government in Parliament. There is an independent judiciary under the Constitution and persons are guaranteed fundamental rights and freedoms irrespective of “. . . race, place of origin, political opinion, colour, creed or sex, but subject to respect for the rights and freedoms of others “

The Public Service of Barbados serves as the administrative machinery for implementing the policies of the Government with established legal frameworks and guidelines and in keeping with its political mandate. Although the Public Service is a unified service, its functions are varied and diverse with an array of Ministries, Departments, Divisions, Corporations and Boards. The complement of these entities is subject to change contingent on the programmes of the administration in place at the time, but all entities implement policy at a national level. The country is administered as one jurisdiction even though there are eleven parishes and twenty-two constituencies. The Ministries of the Environment and Agriculture are primarily responsible for formulating climate change policy while the ministry of agriculture is primarily responsible for its implementation within the agricultural sector.

2.4.3 Regional Governance Structure

The main regional governance structures within the Caribbean region are CARICOM and the Organization of Eastern Caribbean States (OECS). For this study, CARICOM will be the regional governance structure of focus due to its direct governance relationship with the country under evaluation and its mandate within the Caribbean region. Established in 1973, the Caribbean Community (CARICOM) is an organization of 15 Caribbean nations (inclusive of Barbados) and dependencies. CARICOM's main purposes are to promote economic integration and cooperation among its members, to ensure that the benefits of integration are equitably shared, and to coordinate foreign policy. Its major activities involve coordinating economic policies and development planning; devising and instituting special projects for the less-developed countries within its jurisdiction; operating as a regional single market for many of its members (CARICOM Single Market); and handling regional trade disputes. The main organs of CARICOM are the Conference of Heads of Governments, The Community Council and The CARICOM Secretariat.

The CARICOM Conference of Heads of Governments is the supreme Organ of the Community; it determines and provides policy direction for the Community and dictates the relationship between member of the Community, international organizations, and States. It is comprised of a quasi-Cabinet of the individual Heads of Government who are given specific specialized portfolios of responsibility for overall regional development and integration. The Community Council has primary responsibility for the development of Community strategic planning, monitoring, evaluation, and co-ordination in the areas of economic integration, functional co-operation, and external relations. CARICOM Secretariat is the chief administrative organ, it handles Foreign and Community Relations and provides dynamic leadership and service, in partnership with Community institutions and Groups, toward the attainment of a viable, internationally competitive, and sustainable Community, with improved quality of life for all.

CARICOM has grown into an institution with strong policy scope, institutional depth, representation, and executive control that extends into the national level jurisdictions of CARICOM member states inclusive of Barbados. However, CARICOM lacks fiscal autonomy and does not have any influence on how Barbados distributes national tax revenues or reforms its constitution. CARICOM does not have the ability to borrow. Within CARICOM, climate change

adaptation within the agricultural sector falls under the responsibility of the Caribbean Community Climate Change Centre and the Caribbean Agricultural Research & Development Institute.

2.4.4 International Governance Structure

The primary formal organization coordinating activities between states on a global/international level and the only inter-governmental organization with a truly universal membership (193 governments) is the United Nations. The main organs of the UN are the General Assembly, the Security Council, the Economic and Social Council, the Trusteeship Council, the International Court of Justice, and the UN Secretariat. All were established in 1945 when the UN was founded. The General Assembly is the main deliberative, policymaking and representative organ of the UN. The Security Council has primary responsibility, under the UN Charter, for the maintenance of international peace and security. The Economic and Social Council is the principal body for coordination, policy review, policy dialogue and recommendations on economic, social and environmental issues, as well as implementation of internationally agreed development goals. The Trusteeship Council was established in 1945 by the UN Charter, under Chapter XIII, to provide international supervision for 11 Trust Territories that had been placed under the administration of 7 Member States, and ensure that adequate steps were taken to prepare the Territories for self-government and independence. The International Court of Justice is the principal judicial organ of the United Nations. Its seat is at the Peace Palace in the Hague (Netherlands). The Secretariat comprises the Secretary-General and tens of thousands of international UN staff members who carry out the day-to-day work of the UN as mandated by the General Assembly and the Organization's other principal organs.

The UN power and authority as a legitimate level of governance within the international arena is demonstrated in its institutional depth, policy scope, fiscal power, representation, executive control, and international law-making capacity. The UN does not have the authority to borrow, independently tax its membership, determine how tax revenues raise are distributed or co-determine constitutional reform. It must be noted however that the UN exerts some level of fiscal control through its system of assessed contributions which forms the basis for levying scaled annual dues on Member States inclusive of Barbados.

2.5 Types of MLG within Levels

2.5.1 National

In the search for the presence of MLG within SIDS with specific reference to climate change adaptation policy within the agrarian sector, it becomes evident that in this case there is on the surface four levels of governance that exist in the context of Barbados. These levels are local, national, regional, and international. However, in reality dispersion of formal authority only takes place from the state to supranational/regional and international institutions as a result of this the measured formal dispersion of authority to the local level as highlighted in table 4 is zero for

the entire column. Based on the Hooghe and Marks (2003) framework for classifying multi-level governance types, the MLG structure at the national level within the context of this research can be classified as being predominately Type 1 and aligns to the key characteristics of type 1 MLG. The climate change governance framework is system wide and limited to 4 jurisdictional levels, the local level is inextricably linked to the national/central governance level. This is consistent with the Type 1 jurisdictions as described by Hooghe and Marks (2003) in modern democracies. Barbados demonstrates this in its trias political structure of an elected legislature, an executive (with a professional civil service), and a court system. This structure has proved itself to be durable, existing with little modification for the last forty-nine years. It is this structure that has been applied to govern climate change adaptation within the agrarian sector. While membership of Type I jurisdictions is non-intersecting, competencies are often shared and overlap. This is most evident in the interaction with the regional governance structure where competencies such as policy making, legislation and representation are shared. Although with respect to Climate Change Adaptation within the agrarian sector there is no national or regional legislation, regarding shared policy making and representation this has become a normal practice. This has been operationalized through the organs of CARICOM. Jurisdictional authority is dispersed to CARICOM through Treaty of Chaguaramas (1973) and the Revised Treaty of Chaguaramas (2001). Jurisdictional authority is dispersed to UN through the UN Conventions signed onto by the government of Barbados. The specific convention acceded to that is relevant to this examination is the United Nations Convention Framework for Climate Change and its associated Kyoto Protocol. In the case of Barbados MLG is deepening above the state.

2.5.2 Regional

CARICOM generally takes the form of Type 1; but as it relates to climate change adaptation policy, a Type 2 approach to governance has dominated since the formation of the Caribbean Community Climate Change Centre in 2005 to coordinate the Caribbean region's response to climate change. It is not abnormal for Type 1 organizations to create Type 2 organization to address specific issues for example UN created WHO to address issues specifically related to health. Adopting this ad hoc, problem driven, coordination and architecture has benefited CARICOM significantly in the formulation and implementation of climate change adaptation policies. CARICOM through its regional framework for achieving development resilient to climate change has hived off key responsibilities across multiple jurisdictions at the local, national, sub-regional, regional, and international level. As a result CARICOM has developed a wide range of trans-national jurisdictions, including routinized meetings of regional government leaders (an Oversight Committee on Climate Change), a regional committee of parliamentary representatives (The Council of Trade and Economic Development- Climate Change Committee), boards of regional planners, agricultural and environmental associations, chambers of commerce, cooperation projects among universities, regional and international partners, joint research projects on regional climate change projects. The approach to climate change governance at the regional level has led to a low level of distributional conflict since the emphasis in each jurisdiction is on pareto optimality in problem solving as described by Hooghe and Marks (2003) rather than distributional bargaining with societal-wide consequences. Type-II forms of multilevel governance are dominated by networks between public and private actors across levels of social organizations

(Hooghe and Marks, 2003) This form of governance has been very evident at the regional level during the last decade.

2.5.3 International

The United Nations is indeed a large International intergovernmental member organization and generally operates under a Type 1 governance structure. The UN was set up as a general-purpose organization and possesses an extremely broad policy portfolio. It dominates the International jurisdictions/arena due to its convening power, the capacity for continuous information gathering and negotiation that are vital for managing problems that transcend national communities. The jurisdictions under which the UN is organized are generally encompass the international, regional, and national level jurisdictions. Its architecture is system wide but has diversified somewhat to provide some flexibility on issues that are very contextual and case specific.

The approach to climate governance by the UN has generally utilized this structure up until the UNFCCC secretariat was created as a type two task specific governance mechanism to coordinate climate initiatives and interactions by the plethora of actors involved at the various levels even outside of the limited traditional jurisdictions of the UN. The following UN programmes UNEP, UNDP and the World Bank were the first under the UNFCCC responsible delivering climate finance through the GEF for adaptation projects and has assisted in formulating climate change adaptation policies through the implementation of projects at the regional and national level. FAO is the main UN organization that should addresses climate change adaptation within the agricultural sector. As a result, climate change adaptation within the agricultural has been a priority for FAO as a strategic objective or as a thematic area of work.

The rise of type two governance within the UN's approach to climate governance has been epitomized by the level of participation by nongovernmental and intergovernmental observer organizations in the Conference of Parties proceeding of meetings and of open-ended contact groups. There are currently more than 1,400 admitted observer organizations (Dingwerth et al., 2013), the majority of which conform to the type 2 governance structure.

2.6 Institutionalization of Climate Change Multi-Level Governance

2.6.1 Levels of Governance & Division of Policy Making Powers

Following a review of the existing policies across levels and the dynamics of their formulation, a ranking of the order of the levels of governance that dominate the climate change policy arena within the MLG structure and in relation to agriculture would reveal that the influence works top down: 1) International 2) Regional 3) National. The local level of governance would not even be accounted for because they are noticeably absent from the policy discourse. The policy and debate on conducting the climate change policy that is specific to SIDS is dominated at the top levels through supranational institutions such as AOSIS and CARICOM and is manifested at the International level through the UN SIDS Conferences and participation in the Climate Change COPs. The majority of climate change policy has been set at the international level but with

significant participation and influence by supranational regional and national governance structures.

In the context of the levels of governance that have been operationalized to address climate change adaptation policy, the relationship between these three administrative levels is very strong. There is a strong vertical integration of policy between the administrative levels of governance and the three levels under examination all show tangible ownership of the policy process. This is mainly as a result of the inclusive nature of climate governance across and between the administrative levels. The inclusive relationship becomes very apparent in the collective exchanges and joint decision making between levels that in many instances makes it difficult to trace the origins of specific policies. This inclusive approach partly results from the fact that climate change can be viewed as a global negative externality and to be appropriately addressed it must be tackled cohesively. In addition to this, the strategic approach taken through AOSIS to ensure that SIDS like Barbados could never be effectively excluded from the bargaining table.

It must be noted that the national administrative level is still largely responsible for the implementation of agreements and actions at the national scale. Therefore, the national administrative level has a central role to play in relations at the various levels. The supranational regional and national levels show increasing political, economic, and administrative interdependence. The national and regional levels are heavily dependent on the international administrative level for technical and financial support. This has been recognized at the international level and this dependency has been harnessed to incentivize implementation of international climate policies at the regional, national, and local levels. Alternatively, Barbados among other SIDS have been at the forefront of pushing for the creation of an international climate funds such as the Green Climate Fund which facilitates direct access without having to use multilateral implementing entities such as UN Programmes and Agencies as a conduit to access international climate financing. This modality transfers some power back to the nation state.

At the international level issues concerning relations between the other levels of governance are strongly dictated by supranational actors such as the EU, regional intergovernmental groupings such as the AOSIS and transnational non-state actors. At the regional level the influence emanates from the cohesive policy direction of national governments/member states and regional non-state actors involved in governance at that level. While at the national level the national government largely influences and decides on the relationship with the other levels of governance. In recent years international actors have been seeking to create spaces for national and local non-state actors to dialogue and advocate their position on the engagement between levels. Strong supporters of MLG such as the EU have used their financial power to ensure that non-state actors are properly included in the policy making process. As a result, there has been growing participation of civil society especially at the level of CARICOM.

2.6.2 Actors Points of Entry & Policy Making Role/Influence

The openness of the climate change adaptation policy arena depends on the level under consideration. The local level governance structure allows for constituency councils to engage in the policy arena directly through the Ministry of Social Care, Ministry of Agriculture, Ministry of Environment, and various government agencies who have a direct or indirect impact on policy.

The Councils are mandated by law to meet regularly with the Ministry of Social Care and express the views of residents of the constituency. In practice as it relates to the policies under examination the constituency councils have been absent from the discourse and has not utilized the open doors to the arena. Councils have no direct access to the regional or international policy arenas.

At the national level, the policy arena is very open and facilitates direct dialogue, a participatory approach to decision making and policy formulation especially within the agricultural sector. The Social Partnership, Town Hall Meetings, National Stakeholder Consultations on Agriculture, and the National Commission on Agriculture are the formal structures available to actors to enter the policy arena. The Social partnership in Barbados is a tripartite consultative, negotiating mechanism for policy-making and economic development. The social partnership consists of government, the private sector, and labour unions. The social partnership has played a strategic role of social dialogue as a mechanism for building national consensus in the search for socially acceptable public policy. However, one weakness of the social partnership is that it is closed pending special invitation to active participation by individuals, groups, networks, and policy advocates such as the Caribbean Policy Development Centre (CPDC), Barbados Agricultural Society, community-based organizations (CBOs), grassroots organizations (GROs), and other NGOs. However, the National Farmers organizations/producer networks, professional and epistemological networks actively utilized all of the other direct gateways into the policy arena at the National level.

The Regional governance level is relatively open, but the points of entry for non-state actors are limited but increasing. In the past this level of governance was mainly open to the intergovernmental network but in the last decade efforts have been increasingly made to open the policy arena to regional NGOs. This increase of openness has been facilitated by a coalition of regional and national NGOs with support from influential intergovernmental and supranational organizations. The involvement of NGOs in the development of the CARICOM's Climate Change Adaptation Framework symbolizes this transition. The regional NGOs see the policy arena at the CARICOM level as a space they have had to fight their way into over the last two decades and they are now reaping marginal success. The University of the West Indies and the Caribbean Development Bank have been able to get access in a technical advisory role and as partners in implementation. This has also been the case for international partners such as the EU and the Canadian Ministry of Foreign Affairs, Trade and Development who currently operate mainly at the regional level through CARICOM. The annual Caribbean Week of Agriculture (CWA) initiated by IICA, supported by a cross section of international actors and endorsed by CARICOM is one of the few opportunities where non-state actors from the national level can join the policy discourse directly without having to go through regional non-state actors. The policy recommendations derived from the CWA and the specific workshops on climate change are developed into policy briefs for presentation to CARICOM's Technical Management Advisory Committee (TMAC) on Risk Management and are ultimately presented to COTED and the Heads of Government for ratification and official endorsement. This forum was intentionally created to facilitate policy input from non-state actors at the national and regional level. However, it gives international actors such as the EU's CTA, FAO, CARDI and IICA a very tangible opportunity to shape the policy outcomes at this level due to their active and dominant participation within this policy space.

At the level of international governance, climate change policy arena is primarily dominated by governments and intergovernmental processes, but from its origins until now the involvement of non-state actors at all levels has been significant. Governments and intergovernmental organizations have free access to this policy arena, and they occupy the nucleus of the policy arena. This is evident from the active participation of the Barbados Government, other governments, CARICOM, AOSIS, the EU and other intergovernmental organizations. Governments have granted nonstate actors extensive access to the international climate policy process, and nonstate actors participate in the meetings of the parties, lobby governments, prepare policy reports, and interact with the public and the media (Raustiala, 2000). As a result, international and regional non-state actors have carved out a permanent place within this arena and have maintained a high level of influence. Within the context of Barbados local and national non-state actors are unintentionally excluded from direct contributions to the climate change policy arena. This occurs because, firstly local and national non-state actors are by and large detached from the UN Major Group System set up to facilitate contributions from non-state actors and therefore as a result this conduit is unavailable. Secondly to actively participate in the international climate change policy arena you require significant funding to support attendance and participation in the conclaves. At the national level there are some exceptions which arise from association with regional and international organizations that facilitate such contributions at the international level, e.g. CERMES through Dr Leonard Nurse and his association the IPCC and CPDC and their association with the UN Major Groups. The latter has only occurred within the last two years.

2.6.3 Degree of Institutionalization

Specifically, as it relates to climate change adaptation policy within the agrarian sector of Barbados the level of institutionalization can be described as medium (see Table 3). Inclusive of the national, regional, and international levels of governance there are only 3 operational levels of authority. There are only three levels of authority because the local governance structure lacks authority and is co-joined with national government. Duplication and overlap of policy making powers does occur at the national level. This has also occurred at the regional level and frequently occurs at the international level.

2.7 Discussion

The predominant form of multi-level governance adopted in the small island state of Barbados at the national level since its independence 1966 has in the case of Barbados been type 1. This type 1 approach to governance has also been applied to the handling of climate change policy within the agrarian sector. The MLG structure within this specific policy arena has achieved a medium level of institutionalization. The adopted type 1 MLG structure and how it has been institutionalized has facilitated the deepening of MLG above the state level, made provisions for national level actors but has presided over the under development of local government. This deepening of MLG above the state level in the case under examination is consistent with the findings of (Schakel et al., 2015).

Starting from the bottom up reveals that at the local level, when self-rule and shared rule is taken into account the local councils lack institutional depth, policy scope, fiscal autonomy, borrowing powers, representation, law making, executive control, fiscal control and the ability to contribute to constitutional reform. In this regard the power and authority of local government to influence climate change adaptation policy within the agrarian sector is relatively weak. In addition, its role as a legitimate layer of government separate and distinct from national government is questionable as all of its revenue and staff are derived from national government. Councils have not utilized the local policy spaces provided and local actors are apprehensive about engaging local councils due to the presumed political affiliations. At the national level the policy arena is very open and facilitates a participatory approach to decision making and policy formulation especially within the agrarian sector. There is a notable increase in authority being dispersed to national civil society organizations through social partnership, stakeholder boards and national consultations since 1993 with the signing and implementation of the first social partnership protocol. However, these avenues have not been properly utilized by local level actors inclusive of the established councils. This situation is compounded since these same local level actors have no direct access to the regional or international policy arena. The opportunity for non-governmental actors to participate in policymaking will in large part depend on their access to resources, their knowledge, and their capacity to effectively represent their sectors of operation. Lovell and colleagues (2002) demonstrate that bottom-up initiatives require support from external agencies in order for them to function effectively within the existing policy arena. When NGOs act in isolation their impact is limited in scope, scale and sustainability (Mendizabal et al., 2006).

The relatively low level of authority and influence dispersed to the budding local councils and actors have negatively impacted the formation and the extent to which climate change adaptation policy has been developed and implemented within the agrarian sector in Barbados. As a result of this, Climate Change adaptation policy within the agricultural sector has not properly taken into consideration the specific needs at the local and community level. Such policies have only manifested themselves at the national level in a very broad-based manner. This has impeded the implementation of these policies at the local level, especially in local farming communities where tailored policies would be most beneficial. The broad-based national level approach that is embedded in the national policy has only proved effective in facilitating the rapid uptake in drip irrigation. Several other climate change adaptation initiatives outlined in the existing policies such as the utilization of greenhouse technology/protected agriculture, mulch, drought tolerant seeds etc. have not achieved the uptake by local farming communities as expected. The relatively low uptake of these initiatives in the face of climate change has negatively impacted the productivity, profitability and the type of adaptation that would foster the development of the sector.

The formation of policy within this sector has been heavily influenced by regional and international governance structures such as CARICOM and the United Nations. Despite CARICOM's lack of fiscal autonomy, a high level of authority has been dispersed to CARICOM facilitating its strong policy scope, institutional depth, representation, and executive control. The consensual dispersion of authority has been manifested in the intentional alignment of climate change adaptation policy in Barbados to CARICOM's policy and UNFCCC. For example, both the National Climate Change Policy Framework and the most recent agrarian policies have been aligned to the CARICOM Regional Framework for Achieving Development Resilient to Climate Change, its associated Implementation Plan 2011 – 2021 and the Regional Food and Nutrition

Security Policy. These developments are not surprising since climate change is a complex problem that is currently being driven by reciprocal interdependence and deliberated in global forums, but implementation usually requires coordination among international, national, and subnational governments (Schakel et al., 2015).

Global agreements set parameters, but the work is done by cities, regions, and localities (Biermann and Pattberg, 2012). International institutions are the topmost levels in an interconnected system in which no level or organization operates unilaterally. Zürn (2010) observes that the international system has been transformed, the supranational, regional, and national levels show increasing political, economic, and administrative interdependence. However, it must be noted that in case of Barbados the national administrative level is still largely responsible for the implementation of climate agreements and actions at the national scale inclusive of the agrarian sector. Therefore, the national administrative level has a central role to play in relations at the various levels. The openness of the policy arena at the international, regional and national level within the MLG structure has provided an avenue for facilitating genuine partnership in the process of policy development and implementation of climate change adaptation policy within the agrarian sector with the exception of the local level. It has led to the participatory development of generally inclusive broad-based non-specific CCA policies that address the needs of non-state actors. However, due to the fact that technical and financial resources are not merged with these policies, the progress of implementation is retarded, and the non-state actors involved often become frustrated. In addition, the low capacity of national and local level actors to hold the national government accountable has had adverse impacts on the implementation and results of the CCA policy. This has resulted in the lack of evaluation and subsequent evolution of the CCA policy. Though achieving a medium level of MLG institutionalization, it is evident that the facilitation of greater participation in policy formulation by non-state actors has not managed to improve accountability and transparency. Strengthening MLG from the bottom-up would go a long way in addressing these deficiencies. With reference to climate change mitigation Ostrom suggests that the benefits of climate interventions are distributed across scales, from the household to the globe, small and medium scale governance units are better suited to build trust and commitment than ones working at a global scale alone (Ostrom). This finding is even more relevant to climate change adaption where the benefits are largely derived at the national and subnational levels.

The national and regional levels are heavily dependent on the international administrative level for technical and financial support in policy formulation and implementation. This has been recognized at the international level and this dependency has been harnessed to incentivize implementation of international climate policies at the regional and national level. This has also been the case for the formation of such policies at the regional and national level. The blueprints for the national climate change adaptation policies have been taken from the regional policies that have been largely financed by organizations at the international level of governance. The national communications on climate change and the Intended Nationally Determined Contributions have all been financed at the international level. This level of governance has insisted that the approach to policy formulation is as inclusive as possible of civil society. However, local level governance structures inclusive of community-based organizations are often not appropriately included in the dialogue. This underscores the findings of the research in stating that the policy and debate on conducting the climate change policy that is specific to SIDS is dominated by supranational institutions such as AOSIS and CARICOM and is manifested at the international level through the

UN SIDS Conferences and participation in the Climate Change COPs. The majority of climate change policy has been set at the international level but with significant participation and influence by supranational regional and national governance structures. The resulting impact of this MLG dynamics and structure is that the adaptation policies of Barbados and specifically within the agrarian sector generally conform to international adaptation policies, but they sharply reflect the regional and national reality. However, as a result of an underdeveloped and underutilized local governance level, the local resolution of CCA policy has not been developed and there is no strong lobby to pursue such policy development that is appropriately contextual, prevents spatial misfits and properly incentivize policy implementation. Furthermore, the heavy dependency on the supranational governance structures for technical and financial support has resulted in the development of policy without access to the technical and financial resources to implement, monitor and evaluate them. This supranational influence without appropriate local level contextualization of policy has conceived climate change adaptation policies with spatial misfits as described by Kotzebue (2012) and inadequate resource alignment to facilitate successful implementation and policy evolution.

This reality has shaped Barbados climate change foreign policy and has seen access to technical and financial resources placed squarely on the table at the international and regional level. This lobby made jointly with CARICOM and AOSIS has achieved some successes including paving the way for the creation of an international climate funds such as the Green Climate Fund which facilitates direct access without having to use UN Programmes and Agencies as conduits to access international climate financing. This modality transfers some power back to the nation state. In addition, this consistent lobby across levels has also achieved the opening up of several sources of bilateral and multilateral technical and financial resources. Several of these sources of funding are available for direct access by civil society. However, the dominant type 1 approach to MLG in Barbados within in the context of CCA has not been agile enough to capitalize on many of the opportunities it has fought hard to achieve. For example, out of at least 20 multilateral and bilateral funding sources available to adaptation measures, Barbados has only accessed less than 5 sources of funding. Furthermore, only one of the funding sources accessed has been used for adaptation within the agricultural sector and this has been accessed through the Global Environment Facility Small Grants Programme (GEF SGP) by civil society organizations for local level adaptation initiatives. Since implementation of the CCA policies within the agrarian sector are impeded mainly by the lack of technical and financial resources, the inability to be agile and decisive in capitalizing on the opportunities created to facilitate implementation can be seen as a disadvantage of maintaining a rigid type 1 form of MLG that is mainly general purpose in a context that would benefit from a type 2 task specific approach designed around the climate change adaptation.

2.8 Conclusion

This paper demonstrates that MLG as a concept transcends EU borders and has achieved a medium level operationalization with reference to the climate change adaptation policy of the small island developing state of Barbados. The type of MLG has been described as largely being type 1 and has been characterized by a general-purpose governance approach, limited to four jurisdictional levels and a rather fixed system wide architecture. The extent to which MLG has been institutionalized has allowed multi-level governance actors at the national, regional and

international level to affect the discourse of the climate change adaptation policy debate and subsequent policy formulation in a very tangible way. Beyond the state the regional and international actors have been the most influential and the state has facilitated this by voluntarily dispersing authority upward without reciprocating such dispersion downward. Thus, facilitating a deepening of MLG above the state. This has led to an imbalance in the MLG structure and the associated climate change adaptation policy. As a result of this supranational dominance, associated imbalance and a deficiency in advocacy at the local level, climate change adaptation policy within the agricultural sector has not properly taken into consideration the specific enabling conditions required at the local and community level; thus, conceiving climate change adaptation policies with spatial misfits. This has the potential to hinder implementation of the policy. Despite this short coming, the presence of MLG has facilitated the participatory development of generally inclusive broad-based CCA policies that address the needs of non-state actors. However, due to a lack of appropriate contextualization and means of implementation these needs, though reflected in the policy, are often not met. The type 1 structure without type 2 augmentation has not been the most effective type to MLG utilized to address climate change adaptation given the scope and nature of climate change. Merging the policy goals and objectives with the means to implement and the appropriate local level contextualization would improve climate change adaptation from the bottom-up.

3. CHAPTER THREE: A MULTI-LEVEL GOVERNANCE APPROACH: CHANGING ENVIRONMENTAL POLICY IMPLEMENTATION FROM THE BOTTOM-UP

3.1 Introduction

Multi-Level Governance (MLG) provides a framework to analyse the internationalization of environmental policy and its impact on the role, power, and authority of sovereign Small Island Developing States (SIDS). Bache (2005) refers to MLG as a system of continuous negotiation among nested governments at several territorial tiers and describes how supranational, national, regional, and local governments are enmeshed in territorially overarching policy networks. The theory focuses on the increased participation and interaction of non-state actors in governance and decentralization of the power from the central state. Given the associated dynamics of MLG, its presence within SIDS ushers in a real opportunity for improved implementation of environmental policy by facilitating the incorporations of non-state actors at the various tiers of the MLG structure. Contextual Interaction Theory (CIT) provides a lens to evaluate environmental policy implementation within an MLG framework and across the three main implementation variables of motivation, cognition, and power. This paper focuses on evaluating empirically climate change adaptation policy implementation within an MLG framework via the conceptual lens of CIT. It seeks to explain whether improved environmental policy implementation can be facilitated in the presence of MLG if the main actors, especially at the local level, possess or are empowered with the appropriate balance of motivation, cognition and power and are held accountable for their actions.

The research in this paper proceeds as follows. CIT as a framework for the evaluation of climate change adaptation policy implementation is outlined and later utilized to address the research questions. A case study approach is applied to climate change adaptation projects in Caribbean, African and Pacific SIDS implemented by the Global Environment Facility Small Grants Programme. Case selection criteria are developed, and 19 cases drawn from the three geographical areas selected. The questionnaire applied by Owens (2008) in the first attempt to create an empirical model for CIT has been slightly modified, adjusting for the shortcomings identified in the first empirical study and widening its application to model climate change adaptation implementation. The survey instrument is then applied via online surveys followed up by interviews through video conferencing arrangements. For each case, at least one implementer “National Coordinator” and target “Grantee” as defined by Bressers (2005) are interviewed. The results of the interviews then undergo quantitative analysis.

3.2 Theoretical Framework

3.2.1 MLG & CIT

Multi-level governance was first conceptualized and solidified by the seminal work by Gary Marks (1992). Marks suggested that MLG is a useful theory to understand and analyse the dynamics of decision making and the distribution of authority within the European Union. MLG is defined by Schmitter (2004) as an arrangement for making binding decisions that engages a multiplicity of politically independent but otherwise interdependent actors – private and public – at different levels of territorial aggregation in more-or-less continuous negotiation, deliberation or implementation processes, and that does not assign exclusive policy competence or assert a stable hierarchy of political authority to any of these levels. Stubbs (2005) agrees with Bache and Flinders (2004) in stating that the concept of multi-level governance provides “a unique opportunity to foster and develop a deeper understanding of the complementarity of a range of theoretical and empirical models and tools drawn from a number of interrelated disciplines and subdisciplines”, this has in many ways been, thus far at least, something of a ‘missed opportunity’ (Stubbs, 2005). The theory focuses on the increased participation and interaction of non-state actors in governance and decentralization of the power from the central state. Given the dynamics of MLG, Oberthür and Gehring (2006) stated that the effectiveness of environmental governance instruments, such as international regimes or environmental instruments, is affected by inter-institutional influence from other regimes or policy instruments. This is inclusive of climate change adaptation policy.

Contextual Interaction Theory (CIT) can be seen as a complementary theoretical model to MLG and it provides a vehicle for understanding climate change adaptation policy implementation in a dynamic multi-level governance context. CIT is used as a basic framework within this research because it allows the influence of different policies from different regimes to be accounted for without attempting to cancel out the important local effects. Additionally, CIT does not reduce the local context to only being important in as far as it impacts on the original intent of the policy. It recognizes its importance of the local context in the expectations that are part of the locally preferred outcome. Local impacts can also be seen to be in a complimentary and contradictory relationship relevant for the precise context in which they are seen in the cases used in the study.

CIT is an actor-based process interaction theory that accommodates for policy implementation within multiple layers of context. Through the lens of CIT policy implementation is viewed as “...process(es) that concern the application of relevant policy instruments” (Bressers, 2004). De Boer & Bressers (2011) eloquently state that: “Implementation results are seen as the product of (inter)actions in the process, like certain adaptive strategies used, which in turn are impacted by a parsimonious set of actor characteristics. These are in turn impacted by specific characteristics of the case specific, the structural (governance regime) and even the wider contexts. The relationship between the possibility for adaptive strategies and the enabling characteristics of the governance regime is put central stage. This is done while playing due attention to its setting in this multi-layered explanatory model.” CIT suggests that policy actors’ motivation, information needs, and level of collaboration are key variables influencing policy and program implementation (Bressers, 2007).

Bressers and colleagues (2016) have referred to the basic assumptions of CIT as quite simple and straightforward. They have outlined the following basic assumptions as central to CIT:

1. Policy processes are multi-actor interaction processes. Both individuals, often representing organisations or groups, or organisations themselves can be considered actors when participating in the process.
2. Many factors may have an influence but only because and in as far as they change relevant characteristics of the involved actors.
3. These characteristics are: their motivation, their cognitions and their resources, providing them with capacity and power (Knoepfel et al., 2011).
4. These three characteristics are influencing each other but cannot be limited to two or one without losing much insight (Mohlakoana, 2014).
5. The characteristics of the actors shape the process but are in turn also influenced by the course and experiences in the process and can therefore change during the process. There is a dynamic interaction between the key actor characteristics that drive social interaction processes and in turn are reshaped by the process. Deliberate strategies of actors involved can try to promote such changes both in other actors and within their own group or organisation.
6. The characteristics of the actors are also influenced by conditions and changes in the specific case context of for instance characteristics of the geographical place and previous decisions that among others can set the stage for some actors and exclude others from the process.
7. A next layer of context is the structural context of the governance regime. This is the context that our Governance Assessment Tool concentrates on.
8. Around this context there is yet another more encompassing circle of political system, socio-cultural, economical, technological, and problem contexts.

3.2.2 Rooted in Implementation Studies

Policy implementation has enjoyed multiple incarnations of definitions. For the purpose of this research we will adopt the definition provided by Bressers and Dinica (2003) which refers to policy implementation as “the whole of all activities and interactions that are connected to the employment of a preconceived set of policy measures”. Policy implementation has undergone three generations of studies. The first generation of studies were dominated by top-down approaches (Pressman and Wildavsky, 1973; Sabatier and Mazmanian, 1980; Sabatier, 1986). The second generation of studies were dominated by bottom-up approaches (Hjern, 1982; Hjern and Hull, 1982; Schofield, 2001).

Top-down approaches could be regarded as essentially prescriptive - what ought to happen but were seen by critics as failing to provide adequate description or understanding of the complexity of interactions taking place in implementation processes. Bottom-up tended to focus on understanding and explanation based on separate cases, so that it is not possible to prescribe towards other cases. From a top-down perspective, bottom-up approaches to conceptualization were criticized for failing to offer any prescriptions for practice, or for offering prescriptions to that policy as executed would be subverted or modified to reflect the interests of the most powerful upon whom action depended, and could potentially be seen as subverting the proper role of governance.

During the 1980s a so-called third generation of implementation models emerged, either focused on the refinement of negotiation and learning conceptualizations of different policy environments, or sought to synthesize elements of the top-down and bottom-up approaches or focus on the policy-action relationship (Sabatier, 1986; Goggin et al., 1990; Palumbo and Calista, 1990).

CIT has offered a new way of looking at concepts of power and negotiation in implementation as the dialectic between structure and agency, reinforces a view of performance, or what happens in practice, as a function of the scope or limitations of scope for action (rules and roles), and the use made of that scope (values and interests). Kotzebue (2012) has noted that contemporary policy implementation definitions reflect the roots of this theory.

3.2.3 Evolution of CIT

CIT is a product of implementation studies and can be regarded as a third-generation implementation theory that is dominated by a bottom-up approach but flexible enough to be applied to top down scenarios. CIT has its roots in understanding and explaining the implementation of policy instruments (Bressers, 1983). This is very evident in the initial version of CIT as the importance of the policy instruments in the implementation process theory took centre stage. It is not surprising that in the early 1980s when the theory was first developed it was named “policy instrument theory”. Bressers (1983) assessed and causally established the relationship between multiple inputs and outputs in a multi-actor process in his dissertation entitled, “Policy effectiveness and water quality policy”. It is noted by Owens (2008) that this publication used the subjective rational decision-making model to create a typology of policy instruments. In addition to the conceptualization of target group reactions, the probability of actual implementation contingent upon the goals, information and power of actors involved in the implementation process was also estimated. Bressers in collaboration with Huzen (1984) brought within the theory the consideration that the combination of independent variables create situations that are capable of explaining response patterns and developed a module addressing instrument legitimacy. Testing the theory in the following year, Bressers et al. (1985) utilized the theory to compare two forms of market based instruments (charges and tradable permit markets). In that same year Bressers and colleagues (1985) developed a comprehensive summary of studies on the efficiency of Dutch environmental policies. Both pieces of research did not lend themselves to providing new theoretical insights.

Further evolution of the theory ensued throughout the 1980's focussing on building the theoretical concepts designed to enable comparing instruments while acknowledging that their efficacy is fully dependent on context factors, testing the theory through empirical application, enhancing the methodological approach and the illumination of the theory's assumptions (Bressers and Klok, 1987; Bressers and Klok, 1988; Grimberg et al., 1988; Bressers and Ringeling, 1989). Owens (2008) in her chronology of the roots of CIT accounts for the persistent evolution of the theory in the early 1990's focussed on expanding, revising and testing the theory's concept. In the later part of the 1990's network theory was subsequently added (Bressers et al., 1995; Bressers and O'Toole Jr, 1998; Bressers, 1998; Ligteringen, 1999). The dawn of the new millennium saw the addition of learning and dealing with uncertainty (Arentsen et al., 2000; Bressers and Rosenbaum, 2000), multiple scale issues (Bressers and Rosenbaum, 2003) and other governance regime aspects such as context (Bressers and Kuks, 2003; Bressers, 2009). Within the first half of the last decade the inclusion of the role of boundary judgments (Bressers and Lulofs 2010) and the elaboration of the strategies used by actors in such complex and dynamic implementation processes and the consequences for the relevance of governance regime characteristics (Boer and Bressers, 2011) took place. Over the years the labels of core characteristics of actors have changed as the theory is refined. For example, what is called information in one version is labeled with cognition in a later version, emphasizing a bit more its subjective nature.

3.2.4 CIT Actor's Core Characteristics

Central to the metamorphosis of Policy Instrument Theory into CIT is the accommodation for the explanatory limitations of theoretical frameworks that only emphasize policy instruments. This limitation is surmounted in CIT through the inclusion of following core assumption: policy implementation is not a single process which turns a focused input into an output, but an interplay of various human interactions (Owens, 2008). Furthermore, CIT postulates that the actions of actors are not only driven by the availability and feasibility of policy instruments, but rather by their core characteristics: their motivation, cognition, and resources, providing them with capacity and power. Therefore, in CIT the policy implementation process is perceived as a social interaction process and as stated by Bressers (2009) these processes are determined by the relevant actors and their core characteristics.

The practicality of this approach is made apparent through real world policy implementation processes where the implementer interacts with the target group to facilitate policy implementation. This interaction does not always result in policy implementation as in many cases they can try to prevent or change policy. The accommodation of and emphasis on the social interactions of the main actors and their core characteristics provide for real world application and allow CIT to explain the rationale for policies changing during implementation and those that are simply not implemented.

The selection of the core characteristic is by no means random but rather they have been distilled from the implementation studies to create a parsimonious set of characteristics that fuel the actions of actors within the context of policy implementation. In addition, the main arguments of CIT with reference to the actors' core characteristics are congruent with a number of well-known and documented areas of the social science literature.

Argument A: That which gives the greatest benefit will be chosen.

Argument B: Whoever has the most power has more freedom to make choices.

Argument C: What is believed to be real is real in its consequences.

Argument D: Interpretations of reality are the product of a social construction.

Argument E: People should want what is good.

Argument F: Rules provide guidelines to what is accepted.

The three core actor characteristics that are central to CIT are therefore supported at the individual and social level within the social science literature. Table 3.1 highlights the main arguments and their alignment to the actor's core characteristics and the level of analysis.

Table 3.1: Perspectives of the Social Sciences

Scientific Perspectives	Individual	Social
Resources (power)	a. Choosing the greatest benefit	b. Those with the most power can choose
Cognitions (information)	c. It is not the facts that are important but instead the interpretation of what is observed	d. Interpretations of reality are the product of social construction
Values (objectives)	e. People should want what is good	f. Rules provide guidelines to what is accepted

(Source Bressers and Kuks (2003)). These characteristics will be expanded in the following sections.

3.2.5 Motivation

Motivation as a core characteristic is the catalyst that initiates and directs the actions and positions taken by actors within the interaction process. Bressers (2004) has identified three primary sources of motivation. Intrinsic motivation, extrinsic motivation, and self-effectiveness assessment respectively. Intrinsic motivation is as a result of an actor's own, or personal, goals and values. Although self-interest which generally refers to actions that maximize personal benefits, is not the sole origin of intrinsic motivation it does play a strong role within the context of shaping personal goals. However as noted by Gatersleben and Vlek (1998), altruistic values can also lead directly to genuine personal goals. Extrinsic motivation originates in the external pressures such as legal obligations (Bressers, 2004; Bressers, 2009; Bressers and Lulofs, 2010). Self-effectiveness assessment through the lens of CIT is akin to perceived self-efficacy, people's beliefs about their

capabilities to produce effects (Bandura, 1994). Within the framework of CIT, this refers one's belief in one's own capacity to complete tasks and reach a personal goal. Bandura (1994) recognizes that self-effectiveness assessment can also exhibit itself as a motivational factor and can play a significant role (Boer and Bressers, 2011). Self-effectiveness assessment can have a demotivational effect if perceived capacity constraints or bars the attainment of personal goals or even the intended action itself. The relationship between capacity and motivation is made explicit by this motivational factor.

3.2.6 Cognitions

The cognition of actors is their interpretations of reality held to be true (Boer and Bressers, 2011), these interpretations are informed by the actors' observation and information processing capacity that are filtered by the actor's frames of reference and interaction with others. This definition of cognition makes it explicit that observation and information processing capacity are important, for example the dawn of the information age has revolutionized our perception and understanding of problems and possible solutions that involve time and space. However, it also makes explicit the importance and relationship with frames of reference and interaction with those of others. This view is supported in the policy sciences as the so-called 'argumentative turn' (Fischer, 1995; Fischer and Gottweis, 2012), it reflects a variety of approaches and a plethora of examples that emphasize that knowledge is produced through mutual interactions, based on the interpretations of the actors' reality that are themselves filtered by frames of reference. Axelrod (1976) refers to some frames of reference as 'cognitive maps', while Schön (1984), Schön and Rein (1994) and later Van Bommel et al. (2014) refer to them as 'frames', Sabatier and Jenkins-Smith (1999) as 'policy core beliefs' and 'deep core beliefs'. Boer and Bressers (2011) note that Dryzek (1997) speaks of 'discourses', thereby also stressing the language dependency of understanding and the role of words, one-liners, stories and the like to guide, but also to restrict and bias understanding.

The common thread in this quoted body of knowledge is that cognitions are not just confined to factual information but are rather more interpretations of one's reality. These interpretations are filtered and influenced by frames and interactions with other actors (Boer, 2012). Within the framework of CIT, the core characteristic cognitions influence other core characteristics such as motivation and capacity & power. The reverse of the preceding statement is also true as demonstrated in Figure 3.1.

FIGURE 3.1: DYNAMIC INTERACTION BETWEEN THE KEY ACTOR-CHARACTERISTICS AND SOCIAL-INTERACTION PROCESSES (SOURCE (BOER AND BRESSERS, 2011))

3.2.7 Capacity & Power

The final core characteristic of CIT is resources. Resources bears dual importance to actors within the CIT framework, it provides the capacity to act and in the relational setting of an interaction process they are also relevant as a source of power (Boer and Bressers, 2011). Within this context resources are referred to as any asset that public and private actors can use to support their actions (Bressers et al., 2016). Implicit within this definition is that resources only become relevant if the actions an actor intends to perform are dependent upon them. Therefore, the possession of resources required by other actors to facilitate their intended actions is a source of power and resources that are irrelevant in one situation may be highly relevant in another (Bressers et al., 2016). The resources that are the root of these powers encompass much more than formal rules, though legal rights and other institutional rules can be an essential, aside from resources such as money, skilled people, time and consensus fundamental to power (Knoepfel et al., 2011). Two sources of power are identified within the CIT implementation process. The first source of power

is the attribution of power to an actor by other actors and the second source being power that is directly linked to the availability of resources (Kotzebue, 2012). Kotzebue (2012) documents that the attribution of power is highly correlated with legitimacy, trust, respect, and fear. Attributed power that is not backed by the access to and availability of resources is unstable and fragile once faced with a challenge (Bressers, 2009; Bressers et al., 2016).

In Figure 1, the relationship between capacity & power and the other characteristics of cognition and motivation are clearly depicted. In today's information age, information is the new currency and therefore actors with great capacity to capture, search and process information are in a better position to act in a way that will be beneficial to them. Power and capacity influence the motivation of actors: for example, access to and the availability of resources is a key motivational factor in the implement a climate change adaptation policy in developing countries especially SIDS that are impacted the most. The relevance of certain resources (e.g. Climate Funds for Developing Countries) influences the demand for and the dependency on them, and this influences the power of resource controlling actors (e.g. Developed Countries). This demonstrates that besides the resources possessed by the actors themselves, of even more importance in shaping the balance of power is the dependency of an actor on the resources of another actor.

CIT recognizes that not just formal powers count, but that power can be based on all kinds of resources. In the case of SIDS, moral authority on climate justice has been the main power resource used in climate negotiations coupled with the sheer number of votes that they wield within the context of the United Nations. It is clear that resources relevant to the intended action(s) of actors not only shape the balance of power, but are also a prerequisite for action as such, determining the capacity to act of any actor (Bressers et al., 2016). The resource base for action (e.g. climate change adaptation within SIDS) can be greatly enlarged by engaging in dependencies with other actors with relevant resources, in some cases at the expense of the loss of autonomy and thus in some cases power (Bressers et al., 2016).

3.2.8 Layers & Context

CIT acknowledges that the policy implementation process is enveloped within specific circumstances that impacts both the actors and the process. Hence the policy implementation process is contextual, and the context is multi-dimensional. CIT has identified three dimensions of context as factors that influence the interaction process and the formation of actors' characteristics. The three contextual factors are the specific context, the structural context and wider context. Each dimension is separate and distinct; they influence the actors' characteristics simultaneously but in different ways (Kotzebue, 2012). Bressers (2009) stresses that the contexts are not understood as a single context but as overlapping layers. The following sections explore these overlapping layers of context.

FIGURE 3.2: LAYERS OF THE CONTEXTUAL FACTORS WITH RELEVANCE FOR ACTOR CHARACTERISTICS

(Source: (Bressers, 2009))

3.2.9 The Specific Context

The specific context as demonstrated in Figure 3.2 encompasses both previous decisions and specific case circumstances. Examples of specific context include previous decisions on targets, instruments and time frames (Kotzebue, 2012) but also includes factors such as social and geographical characteristics where the project is being implemented (Kotzebue et al., 2010). Bressers (2009) states that policy ideas and instruments can also form the starting point of the policy implementation process. This concept blurs the traditional distinction between policy making and implementation as held by Sabatier and Mazmanian (1980), Bignami and colleague (2001), and Van Meter & Van Horn (1975). These scholars do not view previous policy decisions as part of the policy implementation process but rather as a component of policy making or policy reformulation. Kotzebue (2012) asserts that in the real world these analytical distinctions do not constraint the outcomes of previous decisions, irrespective of whether the policy objectives are reached or changed from forming the context for the basis of policy implementation. In a Multilevel Governance context, implementation of decisions of higher authorities often take the form of policy making at a lower level. Next to previous decisions also other specific conditions can matter, like the geographical conditions of the case area.

3.2.10 The Structural Context

The structural context generally encompasses the existing governance structure, and the property and use rights which affect the policy implementing actors. The actors and their associated networks are embedded within the governance structure. The decomposition of the governance structure reveals its levels, scales, networks, and main actors. Societal problem perceptions and perspectives as well as general goal ambitions, and the more general strategies and instruments which affect the policy implementing actors are non-case specific factors within the structural context. Property and use rights, as well as the resources and responsibilities for the implementation, are also part of the structural context (Bressers, 2009; Bressers and Lulofs, 2010). The structural context lends itself to facilitate a multi-level governance assessment utilizing CIT. The evaluation of the International or European policy implementation process which are both multi-level in nature can be easily captured within this context.

3.2.11 The Wider Context

Problems', political, economic, cultural, and technological contexts comprise the wider context. The entire implementation process cannot be understood without also considering the wider context (Bressers, 2009; Bressers and Lulofs, 2010). Kotzebue (2012) notes that compared to the other contexts there is greater consensus within the literature regarding the wider contexts as the components therein are more systematically captured by other models of policy implementation.

3.3 Methodology

CIT was utilized as an evaluation framework for climate change adaptation policy implementation with reference to the research questions. A multiple case study approach is applied to 19 climate change adaptation projects in Caribbean, Africa and Pacific SIDS implemented by the Global Environment Facility Small Grants Programme. The data attained from study was summarized under the main parameters of CIT using the approach of Owens (2008) plus an additional parameter to address accountability and to facilitate the quantitative empirical modelling of CIT using robust regression analysis. The design of the study reflects the four tests of validity discussed by Yin (2009) construct validity, internal validity, external validity, and reliability.

The quantitative data was derived through interviews with the main actors of the selected cases. The semi-standardized interview method was utilized to elicit a greater understanding of the actors' motivations, cognitions, resources, power, and level of accountability. This method allows for predetermined questions presented in a systematic manner but also facilitates further probing by the interviewer beyond the answers provided. A decision was made to interview both process and content-oriented actors in order to ensure a greater level of perspicacity within the interpretation of policy interactions. The interpretation of the quantitative predictive model results

was also informed by and further contextualized through the review of project documents, reports, and other relevant documents.

3.3.1 Case Selection Criteria and Data Gathering

The questionnaire applied by Owens (2008) in the first attempt to create an empirical model for CIT was slightly modified, adjusting for the shortcomings identified in the first empirical study and widening its application to climate change adaptation. The survey instrument is then applied via online surveys followed up by interviews video conferencing arrangements. For each case, at least one implementer “National Coordinator” and target “Grantee” as defined by Bressers (2005) are interviewed. Case selection criteria were considered, and the decision was made to randomly select completed adaptation projects from Caribbean, African and Pacific SIDS. In total 19 cases were drawn from these three geographical areas. Initially, 44 cases were identified representing 22 countries within the CBA portfolio, but number cases were reduced due to the difficulty accessing data from several policy targets who were challenged by language, appropriate communication technology and remoteness.

3.3.2 Specification of Independent Variables

The relationship between characteristics of actors and the degree of cooperation within a selected implementation process is established within CIT (Owens, 2008). To establish this relationship the independent variables of the actor’s characteristics are defined in terms of the motivation, information, and power for both the implementer and target. For the purpose of this research the implementer refers to the actor officially commissioned with promoting the envisaged measures while the target refers to the actor required to realize the measures. This conforms to the classification of actors by Bressers (2005). The underlying concepts of the independent variables “actors’ characteristics” have been explored in the previous sections, the following tables provide an outline of how these variables are de-constructed into components and their relationship with concepts for use in this application of the theory. Below you’ll find the specifications that Owens (2008) has used:

TABLE 3.2: MOTIVATION CONCEPTUALIZATION FROM THE PERSPECTIVE OF THE IMPLEMENTER

Own Motivation	
Compatibility with goal of implementation	Alignment with implementer and goals
Work-related	Motivation to accomplish task as one's job
Attitude to implementation objective	Personal beliefs about implementation goals
Attitude toward target group	Alignment with target group and goals
Self-effectiveness	Confidence about capacity to perform chosen activity
External Pressure Sources	
Normative	Civic duty in participation, project's value in the community
Economic	Financial reasons for compliance
Social	Social pressure to comply
Political	Political pressure to comply

(Source: (Owens, 2008))

TABLE 3.3: MOTIVATION CONCEPTUALIZATION FROM THE PERSPECTIVE OF THE TARGET

Own Motivation	
Compatibility with goal of implementation	How do the target's goal compare to those of the implementer?
Work-related	Is the target's job-related motivation in support of or opposition to implementation goals?
Attitude to implementation objective	Personal beliefs about implementation goals
Attitude toward target group	Alignment with implementer goals
Self-effectiveness	Confidence about capacity to perform chosen activity.
External Pressure Sources	
Normative	Is there civic or community support or pressure influencing the target's perspective?
Economic	How will the project affect the target financially?
Social	Is there political support or pressure influencing the target's perspective?
Political	Is there political support or pressure influencing the target's perspective?

(Source: (Owens, 2008))

TABLE 3.4: CONCEPTUALIZATION OF COGNITION

General Cognition	
Policy awareness	Basic awareness of the policy
Policy requirements	Knowledge of policy requirements
Policy benefits	Awareness of potential benefits
Knowledge of actors and qualifications	Knowledge of participants and their roles in the process
Transparency	
Documentation	Types of information; quantity and quality of this information
Accessibility of knowledge	Level of difficulty or ease in finding information
Process complexity, uncertainties	Are actors confronted with uncertainties

(Adapted from: (Owens, 2008))

TABLE 3.5: CONCEPTUALIZATION OF POWER

Capacity	
Resources	Financial, administrative, and time support toward the process
Lack of resources	Financial, administrative, and time support lacking in the process
Control	
Formal	Responsibilities and legal powers held by an actor
Informal	Control within the process via less formal channels i.e. any kind of resources another actor needs.

(Source: (Owens, 2008))

Owens captured accountability under Cognition but for the purpose of this current research accountability will be measured as an independent variable separate and distinct from cognition. Accountability for our purpose reflects the accessibility and provision related to the availability and exchange of technical, financial, and other relevant information between actors.

3.3.3 Specification of Dependent Variable

Climate change adaptation within a specified agricultural landscape is the implementation task under examination. Unlike Owens (2008), for the purpose of this research there is only one

dependent variable under consideration in this implementation task. The adequacy of implementation was selected as the dependent variable since it addresses the core concern of this research in identifying the balance of actors' characteristics that improve climate change adaptation policy implementation. Bressers (2004) explains that adequacy of implementation addresses how well the project progresses the intentions of a given policy. Vedung (1997) in his methodology chronicles this progression from input to outcome at highlighted in Figure 3.3. He views public policy as a four-stage process, consisting of input, conversion, output, and outcome. This view is adopted and used pragmatically to reflect, and compliment aspects of the interaction process captured by CIT.

FIGURE 3.3: CONCEPTS OF INPUT, CONVERSION, OUTPUT AND OUTCOME IN RELATION TO IMPLEMENTATION
 (Source: (Vedung, 1997))

In the context of this research, a call for adaptation projects are made by the implementer and the target responds with the submission of a project for proposed implementation. If the project is approved by the implementer and the target agrees with the conditions set, implementation proceeds. If the project is not approved by the implementer or approved with conditions but the target is either not willing or lacks the capacity to appropriately revise the project to meet the condition, then the project is not implemented. Here we are only concerned with approved projects that have been implemented, where a decision has been made and actions taken to modify the physical environment to facilitate adaptation. These cases are assessed for the adequacy or inadequacy of implementation.

The stages of implementation are described below (adapted from (Owens, 2008)) and illustrated in Figure 3.4:

- Actors work to plan a project in a simple or elaborate way (input).
- Actors decide whether or not to implement a climate change adaptation project (likelihood to implement at all; output). If a decision is made to restore, the process continues; if a decision is made to stop, the process ends.
- Actors agree on action to facilitate adaptation, sometimes as a pilot project (planning grant), sometimes as the entire project (adequacy of implementation; immediate outcome).
- Changes are made in the physical environment (adequacy of implementation; intermediate outcome).
- For problems to be effectively addressed, evaluation should occur (feedback).
- Based on evaluation, the project can proceed as envisioned in the original plan, or may be altered to incorporate learning based on the measures implemented (feedback); a project may cycle between making physical changes to the environment and evaluation many times.
- Climate change adaptation is measured by an objective vulnerability reduction assessment (VRA) and adequacy of implementation is assessed from the perspective of both actors.

FIGURE 3.4: CONCEPTS OF PROJECT IMPLEMENTATION FLOW CHART
(Source: (Owens, 2008))

3.3.4 Interview Scoring & Modification of Survey Instrument

Please see Appendix B for the full interview survey instrument and the approach to scoring variables as adapted from Owens (2008). The shortcomings in the survey instruments used by Owens (2008) were identified and additional questions were added to address these deficiencies. To address the failure to capture the relationship between funding and power to implement. The following questions that directly assess core actor funding were included:

- Are your organization's funds for implementing this project immediately available?
- Has the financial capacity of your own organization been a limiting factor in project implementation?
- Has a delay in resources been a limiting factor in project implementation?

Demotivating factors were also not appropriately captured in the original survey. To address this concern the following questions were added:

- Has any factor in this case diminished your motivation for the project?
- Do you believe you can resolve this issue in the course of this project?

To accommodate self-assessment of the implementation, process the following question was added:

- Do you think that this project will be successfully implemented?

The inclusive of specific questions that are used to identify informal power was achieved through the following questions:

- Did you use informal channels such as lobbying or outreach to build support during this project?
- If yes, did this support lead to a change in the situation for stakeholders?
- Do you believe other actors used informal channels such as lobbying or outreach to build support during the project?
- If yes, did this support lead to a change in the situation for stakeholders?

To address the gap in recognizing formal power that the original survey presented, the following set of questions were added:

- Does your organization require regulatory approval before implementing this?
- If yes, from what agency?
- Is your organization responsible for providing regulatory approval before this can be implemented?
- If yes, for what groups or agencies?

Accountability is not directly embedded in CIT, however an important part of this research aims to assess the impact of accountability on the adequacy of implementation. As a result, the following implementation questions were added:

- To whom is your organization accountable?
- For what is organisation accountable for?
- How would you rate the accountability of the main actor involved in the implementation of the project?

The adequacy of implementation has to be assessed in a manner that facilitates an objective and scalar evaluation. Therefore, the following questions were added:

- How would you rate the adequacy of the adaptation methods implemented in achieving the stated goals and objectives of the project? Scale from 1-5
- What percentage of the adaptation methods were successfully implemented?
- What the total change between the first VRA and the last VRA result?

3.3.5 Implementation Data

The case study cross sectional data required for the adequacy of implementation analysis include case scores on motivation, cognition, power, accountability, and balance of power pertaining to both main actors involved in the policy implementation process. There were two organizations assessed per project, the policy implementer, and the policy target. They were both scored independently after completion of their interview and questionnaire. Table 3.6 shows a summary of the quantitative data extracted from the questionnaire to facilitate the modelling of the relationship between the adequacy of implementation and the selected implementation parameters.

TABLE 3.6: SCORED CASE

Cuba - (Community actions to adapt to climate change in rural communities of the Sierra Maestra cooperative in the South Plain of Havana-Matanzas - Sierra Maestra cooperative)

Adequacy of Implementation				
Actors	Motivation	Cognition	Power	Accountability
Implementer: SGP Cuba	18 _{/27}	16 _{/17}	1 _{/18}	2 _{/2}
	$((18/27)-0.50) * 2 = 0.5$	$(16/17) = 0.94$	$(1/18) = .05$	$(2/2) = 1$
Target: Sierra Maestra cooperative	10 _{/27}	13 _{/17}	6 _{/18}	2 _{/2}
	$((10/27)-0.50) * 2 = -0.26$	$(13/17) = 0.93$	$(6/18) = .33$	$(2/2) = 1$
		Power of Implementer Score – Power of Target Score = Balance of Power	$(.05 - .33) = .17$	

As reflected in Table 3.6 motivation, information, and power scores are based on calculating responses to interview questions found in Appendix B. The interview instrument includes 27 points of assessment for motivation, 17 points for Cognition, 18 points for power and 2 points for accountability. With reference to motivation, responses are assigned positive or negative points based on whether they reflect motivation for or against the project. This results in a score that is the proportion of pro-implementation responses divided by the total number of relevant responses. This would normally lead to scores that exist on a scale from 0.0 to + 1.0 but transformation is undertaken to ensure conformity to the theory conceptualization of motivation. Motivation in CIT is discussed in terms of “lack of” motivation, or in terms of positive or negative motivation. Therefore, to achieve this we transform the score to a positive/negative scale by first subtracting .50 from all original scores, changing the scale of (0.0 to + 1.0) to (-.50 to +.50). The final step involves the transformation of the (-.50 to +.50) scale to a scale of (-1.0 to +1.0) by multiplying the score on the previous scale by 2. This facilitates the representation of the different types of motivation as: -1.00 to -0.21 = negative motivation; -0.20 to + 0.20 = neutral motivation; +0.21 to + 1.00 = positive motivation. Therefore, in Table 3.6 the implementer displays positive motivation (0.5) while target displays negative motivation (-0.26).

With reference to Cognition, responses are assigned positive or negative points to depict the level of cognition held by each actor. The interview score is based on responses indicating positive levels of cognition as a proportion of total number of relevant questions. Since CIT conceptualizes cognition on a scale of (0.0 to +1.0) there is no need for transformation. In Table 3.6, cognition is high for both the implementer and target. A similar approach in calculating cognition is used for calculating power and accountability and this is reflected in the same table above. The balance of power is derived from subtracting the target’s power score from the power score of the implementer. The balance of power is determined by the difference between the two power scores. A difference of (0.0 to 0.14) between the two scores indicates the power is balanced between the actors. On the contrary, a difference of (0.15) points or greater indicates that one actor holds the balance of power. Therefore, in the Cuban case provided in Table 3.6 the target holds the balance of power.

3.3.6 Adequacy of Implementation Analysis

Adequacy of implementation was estimated using cross sectional data from 19 cases, this is expected to have an impact on the robustness of the analysis as a larger sample size of more than 30 cases would have been ideal. A scaled indicator of adequacy of implementation was taken from both actors and the average score used for each specific case. The main explanatory variables were selected based on CIT and the explanatory variable accountability inserted from the body of implementation studies. Therefore, variables such as motivation, cognition, power, balance of power and accountability were essential to the model. Linear, quadratic, and the cubic functional forms were considered for the robust regression analysis. However, the linear functional form was preferred as this provided the best fit. A robust regression model was utilized as this appropriately dealt with highly leveraged outliers that are not data entry errors without excluding them or impacting the integrity of the model. The robust regression allows for the weighing and

reweighting of observations differently based on how well these observations behaved within the model (Verardi and Croux, 2009).

3.3.7 Statistical Checks

All regressions were checked for heteroskedasticity, autocorrelation and multicollinearity using Stata 16. Heckman Test was utilized to test for sample selection bias, the Lambda was highly insignificant which suggest the selection probability term does not play a role in our unconditional expectation. Therefore, sample selection was random and the use of OLS in this case is appropriate. The graphical method and Cook-Weisberg tests ($\chi^2 = 1.02$ Prob > $\chi^2 = 0.3131$) were used to check for heteroskedasticity as described by William (2020). Stata automatically excluded variables that were collinear. The Variance Inflation Factor (VIF) was used to check and adjust for multicollinearity as described by Maddala and Lahiri (2009).

3.4 Results & Discussion

The general characteristics of actors within the sample of 19 community-based adaptation projects in SIDS as it pertains to contextual intellectual theory parameters are presented in Table 3.7. With reference to motivation, the mean most motivated actor was 0.54, the mean motivation for both actors under consideration was 0.37. The mean target motivation was 0.25 while the mean implementer motivation was 0.50, double that of the target. The implementer in most cases was the most motivated actor. With reference to cognition, the mean cognition for both actors under consideration was 0.52. The mean target cognition was 0.47 while the mean implementer cognition was 0.60. The target on average has a lower cognition than the implementer. With reference to power, the mean power for both actors under consideration was 0.29. The mean power of the target was 0.27 while the mean implementer power was 0.32. The difference/balance of power is relatively small, with the implementer having a bit more power. The mean balance of power score was -0.03. With reference to accountability, the mean accountability for both actors under consideration was 0.75. The mean target's accountability was 0.69 while the mean implementer's accountability was 0.82. The implementer is consistently the most accountable of the two actors. Overall, the mean adequacy of implementation was 3.42 with range adequacy of 0 to 5 which represents totally inadequate and fully adequate respectively.

TABLE 3.7: DESCRIPTIVE CHARACTERISTICS OF ACTORS

Variable	Mean	Std. Dev.	Min	Max
Most + Motivated Actor	0.5426	0.1279	0.26	0.77
Average Motivation	0.3711	0.1742	0.075	0.665
Average Cognition	0.5168	0.2002	0	0.935
Average Power	0.2964	0.1618	0.05	0.59
Average Accountability	0.7513	0.3107	0	1.25
Implementer Motivation	0.4968	0.1712	0.04	0.77
Implementer Cognition	0.6079	0.1639	0.35	0.94
Implementer Power	0.3242	0.2719	0	0.78
Implementer Accountability	0.8158	0.342	0	1
Target Motivation	0.2453	0.2515	-0.26	0.7
Target Cognition	0.4732	0.2328	0	0.93
Target Power	0.2687	0.148	0	0.61
Target Accountability	0.6868	0.4109	0	1.5
Balance of Power	-0.025	0.2183	-0.33	0.42
Average Adequacy	3.4211	1.2612	0	5
N	19			

With reference to Table 3.8, the signs, and coefficients of the parameters in the model indicate the contribution of each variables to the adequacy of climate change adaptation policy implementation. The base model contains all the key variables in contextual interaction theory, while the expanded model includes accountability as an additional individual variable. The inclusion of accountability significantly improves the model goodness-of-fit based on both information criteria, AIC, and BIC respectively. However, the expanded model though highly significant and well fitted it still suffered from multicollinearity within the motivation variables. The coefficients and p-values of the motivation variables are affected by multicollinearity, but it does not influence the predictions, precision of the predictions or the goodness-of-fit statistics of the model. The cognition, power and accountability variables are totally unaffected by multicollinearity. Nevertheless, in the restricted model both structural and data multicollinearity was removed for the model. The structural changes were achieved by centering the variable of the most motivated actor and changing the functional form for the implementor's motivation. The data multicollinearity was addressed by excluding those independent variables with high VIFs that did not improve after being structurally adjusted. As a result, the restricted model loses some of its explanatory power relative to the expanded model can be seen within the model

statistics in Table 3.8. The general predictions of adequacy of implementation remains constant across models.

TABLE 3.8: ADEQUACY OF IMPLEMENTATION ROBUST REGRESSION RESULTS

	Base Model				Expanded Model				Restricted Model			
	Coef.	Std. Err.	P-value	VIF	Coef.	Std. Err.	P-value	VIF	Coef.	Std. Err.	P-value	VIF
Constant	-15.06	3.24	0.001	-	-9.270	2.300	0.004	-	5.184	.3548	0.000	-
Most Motivated Actor +	41.64	7.25	0.000	35.21	29.38	4.664	0.000	44.24	10.52	1.564	0.000	4.55
Implementer Motivation	-	-	-	-	-	-	-	-	-5.551	1.033	0.000	4.24
Implementer Motivation ²	-30.47	9.631	0.003	61.51	-26.03	5.596	0.002	78.18	-	-	-	-
Target Motivation ²	.1194	4.910	0.020	22.26	7.241	3.637	0.082	25.69	-	-	-	-
Motivation Gap	.1318	6.682	0.007	119.61	-61.31	19.54	0.014	140.7	-	-	-	-
Average Motivation – Implementer Motivation	-.0153	29.08	0.007	51.95	-14.01	4.503	0.014	61.30	-	-	-	-
Cognition Gap	.1939	1.000	0.072	3.57	-1.880	.4694	0.004	3.58	-1.013	.4325	0.037	1.59
Cognition Gap ²	-4.340	2.313	0.093	3.58	-3.114	1.580	0.084	3.64	-	-	-	-
Sum of Cognition	2.775	.6841	0.003	3.55	1.927	.7125	0.027	3.84	1.694	.3363	0.000	1.84
Power Gap	-15.06	3.240	0.001	2.55	-6.339	1.961	0.012	2.55	-5.054	2.430	0.000	2.08
Accountability Gap	-	-	-		-2.106	.3706	0.000	1.51	-2.813	.4079	0.000	1.14
Model Statistics												
Valid N	19				19				19			
Model Fit (R-Square)	0.81 (***)				0.95 (***)				0.85 (***)			
AIC	51.50				24.92				39.23			
BIC	60.94				35.31				45.84			

GAP = Implementer variable – Target variable: e.g. Power GAP = Implementer Power – Target Power

Sum of Cognition = Implementer Cognition + Target Cognition

The motivation of the most positively motivated actor (M) is highly significant and positive in all models. This suggests that the most positive actor has a very positive impact on the adequacy of community-based adaptation to climate change. This shows that the most motivated actor is driving implementation. This is consistent with CIT according to Bressers (2004), who explicitly discerns situations in which not the so-called implementers, but rather the targets drive the implementation forwards towards more adequacy. The motivation of the policy implementer, in this case SGP is highly significant and negative. Generally, SGP in majority of cases has been highly motivated, this high level of motivation may be contributing negatively to adequacy of CBA implementation. This relationship suggests that SGP's high level of motivation could have a negative impact on implementation possibly through forced implementation. Within the expanded model, the motivation of the target of the policy, in this case the grantee partner is significant and positive. This suggests that given generally uniform level of motivation from SGP the grantee's motivation in response to the CBA policy has the most positive impact on the adequacy of implementation relative to the motivation of the policy implementer. It demonstrates that the adequacy of implementation for adaption policy increases *ceteris paribus* if they are driven from the bottom up rather than top down (Baker et al., 2012).

The expanded model also highlights the motivation gap between the implementer and the target, is highly significant and negative. The wider the gap in motivation between the target and implementer, the less adequate the implementation would be. The gap of motivation between average combined motivation of the target and implementer of the CBA policy and the implementer's motivation is highly significant and negative. This is consistent with the preceding findings, the more SGP's motivation exceeds average motivation and implicitly the motivation of the grantee, the less adequate adaptation would be. This implies that CBA should ideally be a bottom up approach and not driven from the top to ensure that adequacy of implementation is maximized.

The cognition gap between Grantee & SGP in both models is highly significant and negative. This suggests that as the cognition gap increases it impacts on the adequacy of community-based adaptation to climate change negatively. This is consistent with CIT, as the gap in cognition increases adequacy of implementation decreases (Bressers, 2004). The sum of the cognition of both actors is highly significant and positive, CIT suggests that the cognition of all positively motivated actors counts (Bressers, 2004). This suggests that the sum of the overall cognition of actors will have a positive impact on the adequacy of community-based adaptation to climate change. The more cognition (knowledge and understanding) of CBA cumulatively between both actors, the more likely there will be an improvement in the adequacy of implementation. Therefore, the sum of cognition that the cognition gap can be surmounted by joint learning and active cooperation if both actors are positively motivated (Bressers, 2004).

The power/capacity gap between the target and implementer, is significant and negative. The larger the gap of capacity and power between the Grantee and SGP the more inadequate adaptation will be. This gap dictates the balance of power and the larger the imbalance in power the more likely forced cooperation would occur. Although forced cooperation facilitates implementation, it reduces the adequacy of implementation as the implementation of the policy

may not be adequately contextualize to meet the needs of the target, therefore further eroding the motivation of the target or the cognition of the target may not have been appropriately built to address the implementation requirements.

Within CIT, accountability is incorporated within Cognition. However, separating accountability from cognition and placing it as a separate parameter the model goodness-of-fit improves with reference to the model statistics in Table 3.8. Target accountability is highly positively correlated to adequacy of implementation. As the accountability of the target increase so does adequacy of implementation. This demonstrates clearly the impact of accountability on adequacy of implementation (Boer and Bressers, 2011). The accountability gap between the Target & Implementer for the models where accountability is included, is highly significant and negative. This is consistent with the literature as the accountability gap widens, the adequacy of implementation is reduced (Boer and Bressers, 2011).

3.5 Conclusion and Implementation Recommendations

Within the MLG context of this study quantitatively applied CIT demonstrates that community-based climate change adaptation policy implementation adequacy is driven/led by the most positive actor. If the most positive actor is the implementer, one must be cautious on overly zealous motivation on the part of the implementer as this may contribute to forced cooperation thus impacting the adequacy of implementation negatively. To maximize the adequacy of implementation it is important that the process is ultimately owned and driven from the bottom up by highly motivated target actors (Agarwal et al., 2012; Baker et al., 2012; Agrawal et al., 2013).

Contextual Interaction Theory reveals that policy implementation is a balancing act (Boer and Bressers, 2011). An imbalance in cognition between the target and implementer impacts negatively on adequacy of implementation. One should mind the gap and this a major pitfall for implementation. However, this gap can be filled, and balance restored if both actors are positively motivated and active learning ensues. Therefore, cognition between actors is not divided and weighted separately but rather unified and shared among actors. In this way deficiencies in cognition in one actor is compensated for in the other actor. If both actors are positively motivated, active cooperation will ensue and cognition deficiencies can be overcome. However, when there is a conflict between them, the understanding and knowledge (cognition) of one actor can be used to undermine the process. Only when both are positive or at least neutral, such “learning together” is theorized to occur (Bressers, 2004). An imbalance in power between actors impacts implementation adequacy negatively. When the implementer holds the balance of power there is always the possibility of forced cooperation, this reduces the adequacy of implementation as the policy may not be appropriately contextualized to match the target’s needs, capacity, and available resources. Accountability as an individual parameter to gauge adequacy of implementation within the quantitative model provides additional explanatory power and focuses our attention how detrimental the accountability gap is with regards to the adequacy of implementation.

Modalities to more accurately measure and increase the Motivation, Cognition, Power and Accountability of the policy target should be explored at various stage of the policy

implementation process: pre-project approval, on initiating project implementation, midway through the project and approaching the ending of the policy implementation process. Measuring the implementation variables at various stages would allow enough time to take the necessary actions required to adjust the parameters of both actors to maximize adequacy of implementation. This should ideally be done with the use of a far more simplified survey to facilitate a rapid assessment “reduce respondent fatigue” and in conjunction with the quantitative model explored in this paper. The new quantitative model provides the additional advantage of not only predicting whether a policy/project will be adequately implemented or not but the degree of adequacy. With such a model implementation results could be proactively adjusted at a much higher resolution therefore fostering a higher degree of adaptive management within the implementation process. The sample size from which this model was derived though representative of CBA projects within the larger portfolio, the model could benefit significantly from a larger sample size. This would increase the predictive power of the model and mitigate the need for the exclusion of the key target motivation variables due to micronumerosity. It recommended that further study should seek to include all projects within the CBA portfolio to enhance the prediction powers and reliability of the model. In addition, this quantitative approach to CIT should be tested further on adaptation various scales, as this study only focused on adequacy of adaptation policy implementation at the local level. What happens when implementation occurs and the national or regional level, is CIT still a balancing act?

4. CHAPTER FOUR: IMPROVING CLIMATE CHANGE ADAPTATION AND AGRI-ENVIRONMENTAL STEWARDSHIP IN SIDS THROUGH FLEXIBLE MONETARY INCENTIVES DRIVEN BY DEMOGRAPHIC AND GEOGRAPHICAL FACTORS¹

4.1 Introduction

Climate Change is the defining issue of our time, and we are at a defining moment (UN, 2020). This issue is far-reaching; from the shifting weather patterns that threaten food production to rising sea levels that increase the risk of catastrophic flooding, the impacts of climate change are global in scope, unprecedented in scale, and driven by human activities (IPCC, 2018). Urgent drastic action is required as a delayed adaptation to the impacts of climate change will be more difficult and costly in the future (UN, 2020)). The world needs to transition to a low carbon resilience model (UNDP, 2015). The challenge lies in making this transition in a sustainable manner that maximizes social welfare and protects the environment without negatively impacting the economic feasibility of productive sectors.

The agricultural sector is facing an enormous challenge of feeding the world's growing population made worse within the context of climate change (FAO, 2019). The impacts of increased climate variability are jeopardizing agriculture, livelihoods, and infrastructure (FAO, 2019). A profound transformation in the global food and agriculture system is needed to ensure that the adaptive capacity of smallholders is enhanced and that countries transition toward low emission and climate-resilient development (IPCC, 2015). Such a transition is particularly challenging for Small Island Developing States (SIDS) are specially recognized by the UN as unique and particularly vulnerable due to their small size, remoteness, narrow resource and export base, and exposure to global environmental challenges and external economic shocks, including to a large range of impacts from climate change and potentially more frequent and intense natural disasters (UN-DESA, 2010). Barbados is one such small island developing state that has identified the agricultural sector within its Nationally Determined Contributions (GOB, 2015) and Second National Communication (GOB, 2018) as one the most vulnerable sectors.

As a part of the Government of Barbados' policy to improve climate change adaptation, agri-environmental stewardship, and move towards a resource-efficient green economy, the government has introduced several fiscal incentives targeted at farmers in 2008. These incentives are equally provided to all registered farmers who adhere to the rules and regulations of the incentive program. The fiscal instruments and policies have not yet been very effective in

¹ The material presented in this chapter has been submitted to be considered as: Bynoe, D., Filatova, T., & Roy, D. (2021). Improving climate change adaptation and agri-environmental stewardship in SIDS through flexible monetary incentives driven by demographic and geographical factors.

achieving the desired change within the agricultural sector (Shik et al., 2019). Farmers underutilize the incentives, and the level of environmental stewardship and climate change adaptation within the agricultural sector in Barbados remains low (Braithwaite, 2014).

In Europe, agri-environmental stewardship schemes are one of the main tools used to achieve environmental sustainability (Cullen et al., 2018). DEFRA has one of the most compressively designed AES globally, however in a recent report on agri-environmental stewardship and climate change adaptation in England and Wales found that due to lack of geographic-specific focus of the program, the uptake of the AES in the most relevant high priority areas was somewhat limited (DEFRA, 2018). Kleijn and Sutherland (2003) demonstrated that top-down and action-based approaches to AES schemes are sub-optimal in achieving sustainability goals. Shortcomings of these AES schemes include conflicting objectives (Ryan et al., 2015), lack of geographical dispersion (Dupraz and Guyomard, 2019), adverse selection (Espinosa - Goded et al., 2010) and increasing complexity (Auditors and Union, 2011). Experts generally agree that spatially targeted results based agri-environmental schemes created using a multi-actor approach are vital to improving the environmental performance of farms. However, there is still a place for top-down action-based schemes in delivering common interventions at a scale that can affect greater change if some of the shortcomings are addressed (Cullen et al., 2018). However, any improvement in terms of targeting and tailoring the schemes requires a more in-depth knowledge of the factors influencing farmers' uptake (OECD, 2008; Hart et al., 2011), which is currently lacking in the context of SIDS. Choice experiments can be used as a design tool to address the AES design shortcomings identified in the literature (Campbell et al., 2009).

This study utilizes choice experiments (CE), spatial analysis, and socioeconomic data to evaluate the premise that well designed geographically specific payment strategies for AES will improve adaptation and agri-environmental stewardship. The assumption is that such schemes should lead to greater participation by farmers (Ruto and Garrod, 2009), thus resulting in improved environmental stewardship and climate change adaptation within the agricultural sector. The innovation in this design is that it addresses complexity, lack of geographical dispersion, and adverse selection concomitantly. The ex-ante accommodation achieves this for the estimated percentage of high resistant farmers, farm demographics, and the agri-environmental issues within a specific geographical agricultural production zone. In the past spatial consideration within CE studies was not a prominent feature, but the increasing spatial analysis is being viewed critically to CE research (Adamowicz et al., 1998; Johnston et al., 2002; Campbell et al., 2008; Campbell et al., 2009; Brouwer et al., 2010; Johnston et al., 2011; Schaafsma et al., 2012; Meyerhoff, 2013; Schaafsma et al., 2013; Johnston and Ramachandran, 2014; Czajkowski et al., 2016; Interis and Petrolia, 2016; Johnston et al., 2016; Holland and Johnston, 2017; Bakhtiari et al., 2018; De Valck and Rolfe, 2018; Glenk et al., 2019).

The rationale for our CE study was to thoroughly investigate farmers' preferences for critical design attributes of the AES that would foster adaptation in SIDS. There is very little information on AES in developing countries and virtually no such information in SIDS. Therefore, our first broad contribution to the literature is to assist in filling the existing information gaps specifically as it relates to AES policy attributes and its relationship with improved climate change adaptation

within the context of SIDS. The second contribution to the literature and innovation is accommodation for geographic specific payments through the facilitation of differentiation via geographic production zones. The study also demonstrates how adoption rates can be maximized through accounting for farmer heterogeneity and facilitating the identification of different segments of adopters of AES via sociodemographic variables in combination with alternative specific constants.

This study proceeds as follows. First, a brief review of relevant agri-environmental schemes is undertaken, and the relationship with climate change adaptation is established. Subsequently, a description of the case study area, its main characteristics, and the existing agricultural incentive scheme is provided. Then the CE theoretical framework is elaborated, and the associated methodology for its design, implementation, and analysis is outlined. Following this, the results of the CE are analysed and discussed in a manner that facilitates the distillation of policy implications relevant to SIDS in the conclusion of the research findings.

4.2 Background

4.2.1 Agri-environmental Schemes, Adaptation & Policy Attributes

Climate change adaption and environmental stewardship within the agricultural sector have traditionally fallen under the umbrella of agri-environmental policy, and a standard mode of achieving both is the utilization of AES (Jacobs et al., 2019). AES offer payments to farmers for effective land management to protect and enhance the environment and wildlife. These changes in farmers' behaviours and actions facilitate the adaptation to and mitigation of climate change and the building of resilience. Therefore, AES also have an overarching objective to improve climate change adaptation and mitigation (Keenleyside et al., 2011; Jacobs et al., 2019). Factors that influence participation behaviour in AES for Europe and the USA have been extensively studied and documented in the literature (Morris and Potter, 1995; Wilson, 1997; Wilson and Hart, 2000; Wynn et al., 2001; Wossink and van Wenum, 2003). Siebert and colleagues in (2006), followed by Ahnström and colleagues (2009) provide an extensive review of such studies. These factors that are well documented include individual farmer and farm characteristics such as age, education, and farm size. Besides, scheme factors such as financial incentives offered and a range of other design elements such as the length of the AES contract and the ability of the farmers to choose what land they wish to enter a scheme (Ruto and Garrod, 2009).

Consensus has also been reached in the literature on the correlation between farmers' participation in AES and farmers' attitudes and behavioural responses (Wilson and Hart, 2001). Other studies focus on transaction costs (Falconer, 2000; Mettepenningen et al., 2009) and the role of information asymmetries for contract design of these schemes (Moxey et al., 1999; Ozanne et al., 2001). However, the role and impact of agri-environmental policy factors on increasing the probability of participation of different groups of farmers in agri-environmental schemes have been largely unaddressed in the literature previously to 2009 (Ruto and Garrod, 2009). This gap in the literature has subsequently received increased attention (Hasler et al., 2019) and rightfully so. To maximise participation and associated environmental outcomes in a voluntary AES,

policymakers must account for heterogeneity among farmers preferences (Espinosa-Goded et al., 2010; Auditors and Union, 2011; Hasler et al., 2019). Choice experiments have been employed in most parts of the world to address this concern across AES themes including pesticide management (Christensen et al., 2011; Kuhfuss et al., 2016), conservation and biodiversity (Broch et al., 2013; Adams et al., 2014; Alló et al., 2015; Gómez-Limón et al., 2019), land diversification requirements and production practices (Espinosa-Goded et al., 2010; Jaeck and Lifran, 2014; Schulz et al., 2014), carbon sequestration and climate mitigation (Aslam et al., 2017), water quality improvements (Beharry-Borg et al., 2013; Franzén et al., 2016) and rural development contracts (Villanueva et al., 2017).

The deficiency within the literature remains within the context of SIDS, there are only a few examples in the literature that sought to address this issue within SIDS (Hess and Beharry-Borg, 2012; Hagedoorn et al., 2019) and both pertained to water quality. Therefore, this study contributes to the literature by assisting in filling the existing information gaps specifically as it related to the context of SIDS.

4.2.2 Case Study

Barbados has been chosen as the case study due to its classification as a SIDS and its current quest to facilitate improved climate change adaptation and environmental stewardship within the agricultural sector in alignment with the green economy. Barbados as seen in Figure 4.1 is situated in the western area of the North Atlantic, 100 kilometres east of the Windward Islands and the Caribbean Sea. It has a total land area of 431 km² and the population size was based on the last census (2010) was estimated at 279,569. The population has been growing at an annual percentage rate of 0.1 (World Bank, 2019) and is ranked 56th on the Human Development Index (UNDP, 2019).

FIGURE 4.1: STUDY AREA AND LAND USE CATEGORIES

Source: (Gohar et al., 2018)

Barbados has one of the most extensive agricultural incentive schemes among Caribbean SIDS (Shik et al., 2019), see Figure 1. The Ministry of Agriculture has over the years, introduced several fiscal incentives targeted at farmers to enhance agri-environmental stewardship and indirectly facilitate climate change adaptation within the agricultural sector. These incentives are equally provided to all registered farmers who adhere to the rules and regulations of the incentive programme. The fiscal instruments and policies have not been very efficient or effective in achieving the desired change within the agricultural sector (Braithwaite, 2014; Shik et al., 2019). The incentives are underutilized by farmers and the level of environmental stewardship and climate change adaptation within the agricultural sector in Barbados remains Low. Critics of the incentive scheme have noted a lack of awareness among farmers as one of the main reason why the scheme is not adequately utilized (Hunte, 2015). Farmers who have engaged in AES have voiced their reluctance to utilize the incentives because of the turnaround time for reimbursements and the fact that you must spend money first to benefit. Brathwaite (2014) refers to this as the inefficiencies of access. In the last three-year efforts were made to rectify

these issues but this has not seen the desired results or change in farmers' behavior as it relates to agri-environmental stewardship and climate change adaptation.

4.3. Methodology

4.3.1 Theoretical Framework & Model Specification

In this study we employed the conditional logit model based on Random Utility Theory to model an individual's choice among a choice set of agri-environmental policy attributes. The Random Utility Theory has already been used in the literature to value environmental policy attributes (Tan et al., 2018; Hilger et al., 2019; Muringai et al., 2020) . In this framework, given a finite set of alternative policy options characterised by distinct agri-environmental scheme attributes, the individual n chooses the policy option i that provides the highest utility. According to the Random Utility Theory, the utility of the goods or service, in our case the agri-environmental policy, is the sum of a deterministic component, V_{in} , and a random component, ε_{in} . Therefore, the general model can be specified as a stochastic conditional (conditional on the choice made) indirect utility function of the form

$$U_{in} = V_{in} (y_n - P_i, Z_i, C_n; \beta) + \varepsilon_{in} \quad i = 1, 2, 3, \dots, I \quad n = 1, 2, 3, \dots, N \quad (1)$$

where y_n is income of farmer household n , P_i is the payment offered to farmers for the policy choice option i , Z_i is a vector of observed policy attribute(s), C_n is a vector of observed individual characteristics and β is a parameter vector. The probability that individual n chooses policy i rather than policy j is

$$P_n(i) = P(V_{in} (y_n - P_i, Z_i, C_n; \beta) + \varepsilon_{in} \geq V_{in} (y_n - P_j, Z_j, C_n; \beta) + \varepsilon_{in}) \quad (2)$$

Assuming that the random component follows an *i.i.d.* extreme value type I distribution. The probability that individual n chooses policy i can be written in a logit model of the following form:

$$P_n(i) = \frac{\exp(\mu V_{in})}{\sum_{j=1}^I \exp(\mu V_{in})} \quad (3)$$

where I is the number of policy choice options, and μ is a scale parameter, which is usually assumed to be equal to one. Expression [3] is the basic equation of a conditional logit (cf. Greene, 2003). The conditional indirect utility function, V_{in} , considered in this study is assumed to be linear in parameters.

$$V_{in} = \beta_0 + \beta_y(y_n - P_i) + \beta_1 Z_{1i} + \beta_2 Z_{2i} + \dots + \beta_h Z_{hi} \quad (4)$$

In our choice experiment we used a conditional logit model; this means that we assume that the values of the choice characteristics vary across choices, while the parameters are common across the choices. See for instance the studies by Chattopadhyay et al. (2005) and Earnhart (2001). In this case, the social and economic characteristics of the farmers are constant across choices for any given farmer; they can only enter the model as interaction terms with the policy attributes. Please

see Table 6 that shows how the models were applied. The variable β_0 , is the alternative specific constant/status quo. In the Base Model only the policy attributes are included. The variable *SW*, soil and water conservation, the variable *SFP*, synthetic fertilizer and pesticide reduction, the variable *PA*, protected agriculture, the variable *RE*, renewable energy, the variable *REB*, rebates and variable *ECOL*, eco-label are all policy attributes. For the Expanded Model, interactions with alternative specific constant policy attributes are added to the model along with case specific variables that represent the individual characteristics of farmers and their geolocations. The Restricted Model was achieved by removing policy attributes that were insignificant in the expanded model.

The conditional logit model is estimated using the maximum likelihood estimation method. Once the model parameters are estimated and assuming constant marginal utility of the income, a welfare measure can be estimated. For instance, for a farmer n facing a choice set i the expected compensating variation (CV) (Chattopadhyay et al., 2005) can be computed using the following expression:

$$E(CV) = \frac{\ln \sum_i \exp(V_{i1}) - \ln \sum_i \exp(V_{i0})}{\gamma} \quad (5)$$

where γ represents the constant marginal utility of income, and V_{i1} and V_{i0} represent indirect utility functions after and before the change considered in the choice experiment. Moreover, the estimated coefficients can be used to estimate the marginal cost of each attribute which, is equal to the marginal willingness to accept (WTP or WTA) for that attribute. The marginal WTA/WTP for a change in a single attribute can be represented as a ratio of coefficients:

$$MWTP = -1 \left(\frac{\beta_{attribute}}{\gamma} \right) \quad (6)$$

CV and MWTP/MWTA are used as inputs into the simulation and evaluation farmers' participation within the AES with associated cost based on policy attributes and associated payments offered for participation in the programme. The option of considering the change in the probability of participating in the AES due to a change of the level in one or more policy attributes pursued using the logit probability. The logit probability of choosing alternative i rather than alternative j is given by:

$$P_i = \left(\frac{e^{\beta x_i}}{\sum e^{\beta x_j}} \right) \quad (7)$$

where x is a vector of attribute coefficients.

It must be noted that the mixed logit model was also initially employed but when the model was ran as random utilizing the available data although it converges when the alternative specific constants (ASC) are used the likelihood-ratio test states that the fixed model is better. Therefore, the conditional logit model was selected based on the characteristics of the data under evaluation. To accommodate for any heterogeneity and address the independence of irrelevant alternatives (IIA) within the model the inclusion of ASC together with socioeconomic variables were utilized

(Bennett and Adamowicz, 2001). In context of this evaluation mixed logit model is not very relevant as the only additional utility it will add is unobserved taste variation.

4.3.2 CE Survey Design

The selection of scheme attributes for a CE Survey of this nature must be carefully designed to achieve local contextualization. Therefore, focus group discussions were held in April and May 2016 in Barbados, to determine local farmers' attitudes towards AES design components such the payment vehicle and to determine the main factors of AES that would influence farmers' participation. Besides, these discussions also identified environmental and adaptation actions deemed as most important to policy makers, technocrats, and development partners. This approach to the selection of the final scheme attributes is consistent with Ruto & Garrod (2009) and Alcon & Colleagues (2014). The choice sets reflecting the attributes and attribute levels identified by an extensive review of the literature and focus group discussions with stakeholders are outlined in Table 4.1 below:

TABLE 4.1: PROGRAMME ATTRIBUTES AND LEVEL DETERMINED BY STAKEHOLDER CONSULTATIONS

Scheme Attribute	Description	Attribute Level
Land Tax Reduction per Acre	The per acre land tax reduction under the scheme	\$ 100, \$ 150, \$ 200
Soil & Water Conservation and Management	Implementation of recommended and agreed farm practices to conserve and manage soil and water to enhance the quality and availability of these resources.	Yes, No
Protected Agriculture	The production of commodities under protected structures.	Yes (at least 400 sqft per acre), No
Restricted and reduced Synthetic Fertiliser & Pesticide Use	Farming Systems that exclude or limit the use of synthetic fertilisers, weedicides, and pesticides. Accompanied by Good Agricultural Practices (GAPS)	30%, 40%, 50%
Renewable Energy	The utilisation of renewable energy on	Yes (the utilisation of renewable energy for at least one major farm activity), No

	farm to facilitate production.	(no utilisation of renewable energy)
Rebates	Farmers will be refunded an agreed amount of the money spent on environmental stewardship and climate change adaptation practices and technologies.	30 %, 40 %
Eco-Label	Whether or not an eco-label will be provided to those farmers who participate in the programme.	Yes, No

Utilizing CE applied to the selected attributes allows for the measuring of trade-offs between attributes that could be made to facilitate participation and the modification of farmers' behaviour. Based on the seven scheme attributes highlighted in the preceding table and the associated attribute levels, the possible combinations for the choice sets are expansive. Therefore, JMP Version 12 software and the experimental design techniques outlined by Louviere and colleagues (2000) were employed to obtain a randomised orthogonal main effects design with 99.56 Chi^2 efficiency. This method was also utilised by Mamkhezri and colleagues (2020) in a choice experiment relevant to renewable energy and by Cheze and colleagues (2020) to assess ufarmers WTA to reduce pesticide use. Table 4.2 below presents an example of one of the choice cards that resulted from our design.

TABLE 4.2: EXAMPLE OF PROGRAMME'S CHOICE CARD

PROGRAMME ATTRIBUTES	OPTION 1	OPTION 2
SOIL & WATER MANAGEMENT PRACTICES (Used as Recommended & Agreed)	No	Yes
PROTECTED AGRICULTURE USE	No	No
SYNTHETIC	50%	30%

FERTILISER AND PESTICIDE USE (Restricted & Reduced)
RENEWABLE ENERGY USE	Yes	Yes
REBATES (On all approved CCA & AES Practices)	30%	30%
ECO-LABEL	Yes	No
LAND TAX REDUCTION PER ACRE	\$ 300	\$ 200

Which option do you prefer?

☐
OPTION 1

☐
OPTION 2

☐
NONE

To arrive at this final design, the criteria of maximising *D-Efficiency* and *A-Efficiency* scores while minimizing the correlation and number of choice cards were used. The goal of D-Efficiency was to maximise the determinant of the information matrix, while A-optimality attempts to minimise the sum of the variances of estimated coefficients. Rose and Bliemer (2013), Demirkale et al. (2013) and Singh et al. (2015) focused primarily on D- Efficiency to achieve smaller standard errors in model estimation at smaller sample sizes. While Sun and Dean (2015), Sun and Dean (2017), and Chai et al. (2017) have focused on A- Efficiency. The most optimal design achieved a high D-Efficiency (91.3), A-Efficiency (82.3) and fewer choice sets (8 choice sets per survey). This design offers the best of both worlds. Two surveys were used, and two choice sets were employed to reduce the number of choice sets faced by each respondent from 16 to 8. Each choice set presented two programmes and an opt-out option.

The CE survey was tested in November 2016 through focus groups of farmers representatives and administered from February 2017 to March 2018 using face-to face interviews with farmers. The survey was conducted by trained enumerators employed by the Ministry of Agriculture within the main agricultural zones targeting farmers who farm within those zones. Random samples were taken from the formal registered farmers list provided by the Agricultural Services Department of the Ministry of Agriculture

4.4 Results

4.4.1 Descriptive Statistics of the Respondents

The general characteristics of farmers within the sample concerning socioeconomic and demographic characteristics, attitudes and previous environmental behaviour are presented in Table 3 and Table 4. The last agricultural census data (GOB, 1989) available is some 31 years ago, the current sample used in this study appears rather representative of the previous census with regards to the average age of farmers, household size and crop production distribution. Stark differences can be seen in education, sugarcane production distribution and the average land under production. The difference in educational level is consistent with the improvement within the educational system over the period that elapsed. It is now mandatory that all children have a secondary school education. While the amount of land under sugar production has declined significantly in the last 30 years. The average farm size is higher, that is expected due to the inclusion of large plantations within the sample.

The sample is consistent with the gender imbalance among farmers in Barbados, 78.8 % of the respondents are male. The average age of respondents is 48, this represents a small reduction in the average age of farmers since the last agricultural census was undertaken and falls within the range of the average age of farmers within the SIDS of the Eastern Caribbean (Graham, 2012). Married farmers represent 42.7% of respondents and an average household size of 3.5. The average farmer has an average income of \$2860.5 but the income range is wide. Most respondents are not farming within an irrigation district (80.6%). Most farmers are involved in crop production (80%), followed by livestock production (46%) with the minority of farmers engaged in sugarcane production (5%). The decline in world market prices for sugar and the loss of preferential markets has led to consistent decline in the number of farmers engaged in sugarcane production. The average acreage under production for respondents is 7.7. A minority of respondents have received training areas related to agriculture that would improve agri-environmental stewardship and climate change adaptation such as organic agriculture (18%), renewable energy (17%), water conservation and management (37%), soil conservation and management (30%), good agricultural practices GAPs (35%) and protected agriculture (18%).

**TABLE 4.3: SOCIO-ECONOMIC AND POPULATION CHARACTERISTICS
(N=97) AND THE FARMERS' POPULATION**

	Last National Agricultural Census (1989)	(Percentages and mean Values)	SD	Range
Gender (% of Males)	61%	78.8%	0.41	0-1
Age	41-54	48.1	16.67	0-77
Civil Status (% Married)	-	44%	.497	0-1
Size of Household	3-4	3.5	1.84	1-9
Education	1	2.2	.60	0-3
Income (\$/month)		2860.5	1769.134	600-10000
Production Zone/Parish	-	8.38	3.64	0-11
Irrigation District		20.41%	.40	0-1
Crop Production	87%	80%	.40	0-1
Livestock Production	-	46%	.50	0-1
Sugar Cane Production	13%	5%	.22	0-1
Average Land Under Production (Acres)	4.09	7.7	42.27	0-360
Agricultural CCA Training:				
<i>Organic Agriculture</i>	--	18 %	.39	0-1
<i>Renewable Energy</i>	-	17%	.38	0-1
<i>Water Conservation and Management</i>	-	37%	.38	0-1
<i>Soil Conservation and Management</i>	-	30%	.46	0-1
<i>GAPs</i>	-	35%	.48	0-1
<i>Protected Agriculture</i>	-	18%	.38	0-1
<i>N</i>	33,368	97	97	97

In Table 4.3, on average the farmers surveyed used mainly synthetic fertiliser and pesticides. Regarding GAPs only 8% of farmer undertake soil test, 46% of the farmers keep proper input records and 77% engage in appropriate storage. Most farmers viewed protected agriculture (64%) and renewable energy (85%) as beneficial but only small minority utilise protected agriculture

(16%) and renewable energy technologies (3 %). Most farmers already utilise organic matter, mulch, water conservation and water harvesting. However, contour ploughing, and the use of buffer zone is only utilised by a minority of farmers. The most important production issue related to climate change is drought. On average farmers are willing to place 5.7 acres within the AES programme with a contract period of 4.23 years.

TABLE 4.4: PREFERENCES, PREVIOUS ENVIRONMENTAL & FARMING BEHAVIOUR (PERCENTAGES AND MEAN VALUES)

	(Percentages and mean Values)	SD	Range
Fertiliser Use	2.07	1.07	0-3
Pesticide use	2.10	0.97	0-3
Basic GAPs			
Input Records	46%	.50	0-1
Proper Input Storage	77%	.42	0-1
Soil Test	8%	.27	0-1
PA Beneficial	64%	.48	0-1
PA Use	16%	.37	0-1
RE Beneficial	85 %	.36	0-1
RE USE	3 %	.17	0-1
Soil Conservation & Management			
<i>Contour Ploughing</i>	18%	.39	0-1
<i>Buffer Zone</i>	33 %	.47	0-1
<i>Organic Matter</i>	69%	.46	0-1
<i>Mulch</i>	60%	.49	0-1
Water Conservation & Management	73%	.44	0-1
<i>Water Harvesting</i>	51%	.50	0-1
<i>Water Conservation</i>			
No. Acres in Programme	5.74	34.50	0-300
Maximum Contract Period	8.57	4.23	5-15
Production Zone Issue	1.42	1.17	0-5

GAPs: Good Agricultural Practices PA: Protected Agriculture, RE: Renewable Energy

As outlined in Table 4.5, the survey revealed the most important attributes to farmers who participated in the survey and least likely attributes to be implemented if the programme was initiated. It is not surprising that water conservation and management is the most important variable given that in Table 4.4 the most important production issue relevant to climate change is drought. The regulation of synthetic inputs followed this. The least likely attributes of the programme to be implemented would be protected agriculture followed by renewable energy.

TABLE 4.5: MEAN OF RANKED ATTRIBUTES AND LIKELIHOOD TO IMPLEMENT

	Mean	SD	Range
Most Important Attributes			
1. Protected Agriculture	3.51	1.49	0-5
2. Soil Conservation & Management	3.29	1.47	0-5
3. Renewable Energy	3.18	1.47	0-5
4. Regulation of Synthetic Inputs	2.55	1.32	0-5
5. Water Conservation & Management	1.96	1.01	0-4
Least Likely Attributes to Implement			
1. Water Conservation & Management	3.55	1.32	0-5
2. Regulation of Synthetic Inputs	3.42	1.42	0-5
3. Soil Conservation & Management	2.69	1.24	0-5
4. Renewable Energy	2.60	1.52	0-5
5. Protected Agriculture	2.21	1.50	0-5

Crosstabs and Correlations were used to examine the data more closely and determine which variables are most relevant within the mixed logic regression please. Stata automatically excludes collinear variables from the regression.

4.4.2 Economic Model

The conditional logit model for the population sample is presented in Table 4.6. The initial models contain all of the experiment's attributes and relevant case specific variables. Variables that within the model that caused multicollinearity were removed from the model and the Wald Chi-Squared Test was used to determine the significance of the model fit with reference to the explanatory variables. The likelihood-ratio test was used to determine the appropriateness of the random effects model over the fixed effects model. The Akaike information criterion (AIC) and Bayesian information criterion (BIC) were used to compare regression models information criteria (IC) tests to determine the improvement of goodness of fit over the base model with only programme attributes. Both measures account for the goodness of fit of the model and its parsimony. While each measure penalizes a larger model for using additional degrees of freedom and rewarding improvements in goodness of fit, the BIC carries a higher penalty as degrees of freedom increases. The signs and magnitudes of the parameters in the model show the contribution of each variable relative to the individual's utility and probability of participating in the AES programme. Therefore, larger positive coefficients increase the probability of participation while larger negative coefficients reduce the probability of participating given the parameter is significant within the model. Insignificant attributes do not improve or reduce individual utility and therefore will not impact participation within the AES programme.

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TABLE 4.6: CONDITIONAL LOGIT MODELS

	Base Model			Expanded Model			Restricted Model		
	Coef.	Std. Err.	P > Z	Coef.	Std. Err.	P > Z	Coef.	Std. Err.	P > Z
Constant	.1705	.1413	0.227	1.4533	.5130	0.005	1.417	.5048	0.037
Payment	.0058 ***	.0016	0.000	.0060	.0018	0.001	.0057	.0017	0.001
Soil & Water Management (SW)	.8227 ***	.3060	0.007	.9229	.3364	0.006	.7381	.2462	0.003
Reduced Synthetic Inputs (SFP)	.0023	.0092	0.800	.0017	.0101	0.869			
Protected Agriculture (P.A.)	.0927	.1571	0.555	.8426	.3890	0.030	.9313	.3787	0.013
Renewable Energy (RE)	.1922	.2071	0.354	.5937	.4390	0.176			
Rebates (REB)	-.0159	.0206	0.441	-.0169	.0222	0.446			
Eco Label (ECOL)	.2451	.1833	0.181	-.2664	.3502	0.447			
PA*RERANK				-.2020	.1011	0.046	-.2115	.0989	0.029
RE*INCOME				.0002	.0001	0.039	.0002	.0001	0.003
RE*RERANK				-.2428	.0968	0.012	-.1521	.0615	0.025
ECOL*WCUSE				.6991	.3835	0.068	.4087	.2162	0.059
WCUSE				.7822	.2985	0.009	.7868	.2940	0.007
FUSE				-.3165	.1141	0.006	-.3062	.1132	0.007
MISCM				-.2957	.0968	0.002	-.2939	.0957	0.002
Production Zone				-.6148	.2914	0.035	-.5984	.2869	0.037
Model Statistics									
Observed Cases	682			670			670		
Model Fit (Wald Chi-Square)									
AIC	20.72 (7)			51.57 (15)			50.01 (11)		
BIC	**			***			***		
	466.38			429.43			424.67		
	497.03			490.46			470.44		

Level of significance: * Significant at 90%; ** Significant at 95%; *** Significant at 99% RERANK: Renewable Energy Rank, ECOL: Eco-Label, WCUSE: Water Conservation Use, FUSE: Fertilizer Use, MISCM: Most Important Soil Conservation & Management

In Table 4.6 the Expanded model and the Restricted model utilised alternative specific constants and individual specific variables to account for the heterogeneity within the model. This improved the model fit in the subsequent models; however, the Restricted model offers the best fit. Within

all three models, soil and water management and the annual stewardship payment were highly significant and positive. This indicated the probability of farmers participating in the AES programme increased as the stewardship payments increased and if soil and water management practices were a part of the programme. Specifically, the probability of farmers participating in the stewardship programme increased by 0.57 % for the Restricted model per dollar offered annually per acre. The inclusion of soil & water management within the AES programme increased the probability of farmers participation by 73.8 %; on the other hand, including protected agriculture increased probability by 93 % in the restricted model. As importance placed on renewable energy decreased for farmers so does likelihood of participating in the programme if protected agriculture or renewable energy is included within the programme, the converse is true. Farmers who viewed renewable energy as most important increased their probability of participation (21%) if protected agriculture was included within the programme. As income increased there was a .02 % increase in the likelihood of farmer participation if renewable energy is included within the programme. Farmers who viewed renewable energy as most important increased their likelihood of participation by 15 % if renewable energy was included within the programme. Those farmers who already used water conservation practices on farm were 40.8 % more likely to participate in the AES programme if an ECOL label was offered.

Farmers who used synthetic fertilisers as their primary source of fertiliser were 30.6 % less likely to participate in the AES programme; those who viewed soil conservation and management as the most important were 29% less likely to participate in the programme. Farmers who were within high rainfall production zone were 59.8 % less likely to participate in the AES programme based on the Restricted model.

TABLE 4.7: MEAN WTA FOR PROGRAMME ATTRIBUTES (C.I. 95%)

	Soil & Water Management (acre/year)	Synthetic Input Reduction (acre/year)	Protected Agriculture (acre/year)	Renewable Energy (acre/year)	Rebate (acre/year)	Eco-Label (acre/year)
Expanded Model	\$153.62 (\$32.76 - \$274.48)	\$0.28 (-\$3.03 - \$3.59)	\$140.25 (-\$4.89 - \$285.39)	\$98.82 (-\$51.94 - \$249.59)	-\$2.81 (-\$10.01 - \$4.39)	-\$44.34 (-\$160.91 - \$72.24)
Restricted Model	\$129.66 (\$30.31 - \$229.02)	-	\$164.73 (\$8.61 - \$320.61)	-	-	-

Table 4.7 shows the programme attributes and what farmers are willing to accept for each respective attribute within the Expanded and Restricted model. The Base model was excluded since none of its parameters were significant. WTA for all attributes within the Expanded model are positive except for Rebate and Eco-Label attributes. Synthetic Input Reduction showed the lowest WTA and Soil and Water Management the highest. Within the restricted model farmers required the largest individual attribute payment (\$164.73) to participate within the programme where protected agriculture is included. The difference between the WTA within the expanded and restricted model for Soil & Water Management was relatively small.

FIGURE 4.2: SIMULATED AES PROGRAMME UPTAKE RATE: BASED ON VARIOUS POLICY SCENARIOS (95% C.I). HERE SW STANDS FOR ‘SOIL & WATER MANAGEMENT’ AND PA DENOTES ‘PROTECTED AGRICULTURE’.

The simulated AES Programme uptake rate in Figure 4.2 demonstrates that as expected higher payments result in a higher percentage of farmers’ participation within the programme. Soil and water management when paired with the same payment per acre as protected agriculture provided a lower policy adoption percentage than protected agriculture. The highest level of participation (81%) within the policy options simulated is achieved by a payment of \$200 per acre and including both programme attributes protected agriculture and soil and water management. Based on the simulation options in Fig 4.2, a payment of \$150 per acre combined with any individual attribute or both protected agriculture and soil and water management provided the highest marginal change in percentage participation, *ceteris paribus*. A payment of \$100 per acres combined with any individual attribute or both protected agriculture and soil and water management provided the second highest marginal change in percentage participation, *ceteris paribus*. Based on the estimated total number of farmers, the average acres per farmer, and 81% participation at a per acres rate of \$200 with the inclusion of soil & water management and protected agriculture would cost \$ 3, 495,400.00 annually.

While 75 % participation at a per acres rate of \$150 with the inclusion of soil & water management and protected agriculture would cost \$ 2, 594,550.00 annually. Finally, a 68% participation at a

per acres rate of \$100 with the inclusion of soil and water management and protected agriculture would cost \$ 1, 176,700.00 annually.

4.5. Discussion

In this section, we discuss the key findings of the conditional logit model estimated using the unique choice experiment survey. The results of the choice modelling analysis for the restricted model demonstrate that farmers have a high probability of participation and are willing to accept a payment \$129.66 per acre/year for an AES programme with soil and water management. Our finding is important given that drought was identified as one of the most important production issues for farmers even if they belonged to an irrigation district. Farmers ranked water management as the most likely component of the programme that they would implement. Moreover, Barbados is ranked 15th as a water scarce country (Cashman and Moore, 2012) and the topsoil is relatively thin, depleted of nutrients and organic matter (ECF, 2016). However, addressing this issue comes at a cost to farmers and therefore farmers require compensating assistance to improve soil and water management on farms.

Protected agriculture as an AES programme attribute also resulted in a high probability of farmers participation and a WTA of \$164.73 per acre/year in the restricted model. Our finding reflects farmers perception of protected agriculture as beneficial (64%), ranking it as the second most likely programme attribute to be implemented if they had to join the AES programme. The probability of participation was even higher for those farmers who view renewable energy as the most important attribute. Such an association is feasible given that most protected agricultural structures used in Barbados require energy to run primarily for cooling and the most common form of renewable energy used in Barbados – “solar” – does not require planning permission if placed on the roof of a protected agricultural structure (BREA, 2020). Therefore, protected agriculture and renewable energy can be viewed as complimentary within the context of Barbados, highlighting the co-benefits between climate change mitigation and adaptation.

Farmers who indicated renewable energy as most important, were more likely to participate in an AES programme with renewable energy as an attribute, conforming to our prior expectations. Further, as income increases the probability of farmers participation with regards to renewable energy also increases. This would suggest that the adoption of renewable energy is income dependent. This is consistent with the uptake of renewable energy in Barbados at the household level, where predominately only middle to high income households utilise renewable energy (BREA, 2020) , as also observed globally (McHugh, 2018). This presents a national and global challenge that must be addressed given that at the national level the Government of Barbados has adopted a carbon neutral policy by 2030 and at the global level Sustainable Development Goal (SDG) 7 aims to achieve sustainable energy for all. Renewable energy solutions that can address the income gap are integral in improving adoption of renewable energy.

Those farmers who currently use water conservation practices on farm are 35 % more likely to participate in the AES programme if an ecolabel is offered. This highlights that an ecolabel is particularly attractive to those farmers who practice water conservation. Farmers who use synthetic fertilisers as their primary source of fertiliser are 31 % less likely to participate in the AES programme. Synthetic fertiliser usage is linked to many environmental problems such as fish kills,

ground water pollution etc., and is the main fertiliser type used by farmers characterised as yield optimisers (Ahnström et al., 2013). Yield optimisers were found to have less interest where the environment is concerned but are rather driven by economic incentives and are less likely to join an AES (Ahnström et al., 2009).

Those who view soil conservation and management as the most important AES attributes, are 29% more likely to participate in the programme. Furthermore, those farmers who are within low rainfall production zones are 54 % less likely to participate in the AES programme based on the Restricted model. These are particularly telling when interpreted in combination with each other since those same farmers who are in high rainfall areas are the farmers who mainly face soil conservation and management issues. Farmers within this group appear to be more willing to participating within the programme overall when compared to the other group of famers.

The fact that rebates do not add significant utility to farmers participation should make government consider redirecting resources from the existing rebate scheme to a targeted AES. The lack of utility from the rebate system is an essential factor as this aligns to the reality that exist where there is a general lack of awareness of the rebate system, which is underutilised by most farmers (Braithwaite, 2014). One of the reasons for this could be a lack of trust in the rebate system and the length of time farmers must wait to receive the rebates. The Ministry of Agriculture in Barbados has sought to address this by offering and upfront concessions (GIS, 2012), but this has also had its challenges (GIS, 2016).

Consistent with utility theory, higher payments result in a higher percentage of farmers' participation, i.e. AES programme adoption rate. Soil and water management when paired with the same payment per acre as protected agriculture offers a lower policy adoption rate. The higher utility to farmers and the resulting higher adoption rate for the protected agriculture could be explained by the reduction of climate-sensitive risks, such as drought and the higher returns that protected agriculture provides directly to the individual farmer when compared to the soil and water management programme attribute. Soil and water management also offers a reduction in climate risk and direct benefits to individual farmers (Schlesinger and Amundson, 2019; Aryal et al., 2020; Lal, 2020). Moreover, many of the benefits of this attribute are expressed in the form of positive externalities that benefit society (Marchi et al., 2018; Eiswaerth and van Kooten, 2019). Although the highest level of participation (81%) within the policy options simulated is achieved by a payment of \$200 per acre and including both programme attributes discussed, the lowest marginal cost within the simulations is for a payment of \$150 per acre (75% participation) based on the three simulations. Utilizing any of these two payment options would result in an annual payment of \$ 3,495,400.00 or \$ 2, 594,550.00 respectively. The agricultural sector represents 3.8 % of the GDP of Barbados, 2.9 % of its jobs and is viewed by the Government as one of the nation's potential growth drivers (Shik et al., 2019). The total transfers to the sector from agricultural policy “\$51,865,000.00” is approximately 1.1% of GDP (Shik et al., 2019). Therefore, adding the AES to existing policy would increase the annual transfer amount from agricultural policy by 6.7% - 5.0 % respectively. Such an increase would warrant endorsement by the taxpayers. Ultimately, the policy decision will be contingent upon whether the constraint is to maximise participation at the lowest cost or to approach maximum participation within a set budget. This budget could be set by government as a substitution for the current incentive scheme

to avoid increasing current annual cost or the budget could be informed by a study of the taxpayers' WTP for the AES.

4.6. Conclusion

This research provides critical insight into the perceptions of the farmers concerning climate change adaptation and AES, and the role of government in a Small Island Developing State. In doing so it adds the rather limited body of knowledge SIDS on AES policy attributes and its relationship with improved climate change adaptation. It makes a clear argument for the utilization of differentiated geographic specific payments to improve AES participation and adaptation even within small states that may be considered too small for this approach to be relevant. The findings emphasize the importance of understanding farmers priorities, structuring programs to respond to these priorities, and embracing flexible forms of participation and program delivery.

Farmers who view soil conservation as most important, use some form of organic fertiliser and practice water conservation are more likely to participate in the AES programme. These revealed preferences suggest that farmers who are more environmentally conscious are more likely to participate in the programme. Farmers who view renewable energy as important are more likely to be involved in the AES programme if renewable energy and protected agriculture is offered as attributes. However, the formal exposure to training in renewable energy and protected agriculture is low among the farming population sampled 17% and 18% respectively. It is therefore recommended that farmers are exposed to training in renewable energy that includes its application in protected agriculture through farmers field schools and the use of demonstration farms. Specific training in protected agriculture would also be beneficial as this is complementary to renewable energy and is an integral farming mechanism to facilitate climate change adaptation.

To improve environmental stewardship and climate change adaptation a national AES programme within SIDS under examination that includes soil and water management and protected agriculture ensures a high farmers adoption rate. The maximisation of farmers participation once both soil and water management and protected agriculture are included depends on the level payment provided. A payment of \$100 will provide 68% participation, a payment of \$150 will provide 75% participation, while a payment of \$200 will provide 81% participation resulting in a total annual budget ranging from \$ 1, 176,700.00 to \$ 3,495,400.00. The production zone influences the probability of participation and therefore it is possible to offer differentiated geographical specific payments to increase the probability of participation within the two different production zones identified within this study. To increase the probability in production Zone 1 higher payments will be required. This differentiation of policy based on spatial analysis offers an excellent opportunity to maximise AES uptake by farmers.

From public policy perspective the payment will be dependent the fiscal space available to the policy makers, the priority placed on AES and adaptation and the possibility of increasing the fiscal space by utilising the public WTP as an indication of the public endorsement for financing the AES programme. Further research is required to determine the public WTP for improved AES and climate change adaptation within the agricultural sector.

5. CHAPTER FIVE: MAINTAINING A TRADITIONAL AGRICULTURAL LANDSCAPE IN A SMALL ISLAND DEVELOPING STATE WITH IMPROVED CLIMATE RESILIENCE & AGRI-ENVIRONMENTAL SERVICES²

5.1 Introduction

The necessity to adopt environmentally friendly farming practices increasingly goes hand in hand with the urgency to address climate change. The main public policy instrument used in Europe and the USA to encourage farmers to support traditional agricultural landscapes and improve climate resilience are Agri-environmental Schemes (AES), which provide financial incentives to farmers who adopt such practices (Cullen et al., 2018). Climate change adaption and environmental stewardship within the agricultural sector have traditionally fallen under the umbrella of agri-environmental policy and a common mode of achieving these goals is the utilization of AES (Keenleyside et al., 2011; DEFRA, 2018; Jacobs et al., 2019). The academic literature provides little evidence of agri-environmental stewardship schemes implementation in Small Island Developing State (SIDS). The UN Department of Economic and Social Affairs lists 57 SIDS, which represent more than a quarter of the 195 countries formally recognized by the UN (UN-DESA, 2020). SIDS are specially recognized by the UN as unique and particularly vulnerable due to their small size, remoteness, narrow resource and export base, and exposure to global environmental challenges and external economic shocks, including to a large range of impacts from climate change and potentially more frequent and intense natural disasters (UN-DESA, 2010).

SIDS continue to address those structural and external challenges to achieve their sustainable development (UN-DESA, 2020) but the limited fiscal space of most SIDS governments constraints them from pursuing and financing AES. Though some AES were implemented in the French West Indies (Blazy et al., 2015), they have been differentiated from SIDS since they are overseas territories of France and therefore were financed by the Government of France. Furthermore, these AES in the French West Indies were largely unsuccessful in delivering desired agri-environmental services, mainly due to poor design resulting in low adoption rates (Blazy et al., 2015). Several SIDS governments have contemplated designing and implementing AES. However, many of these governments have been hesitant to implement such a scheme, mainly due to resource constraints and the lack of a sustainable funding mechanisms.

Choice Experiments (CE) can be applied to address these issues of AES design and adoption rates. Yet, of even more relevance within context of fiscally constrained SIDS is the ability of CE to concomitantly inform the public policy decision to initiate the AES implementation by identifying the revenue base that would sustain the scheme. There are only a few examples in the literature

² The material presented in this chapter has been submitted to be considered as: Bynoe, D., Filatova, T., & Roy, D. (2021). Maintaining a Traditional Agricultural Landscape in A Small Island Developing State with Improved Climate Resilience and Agri-environmental Services.

that sought to utilize CE to address environmental issues within SIDS (Hess and Beharry-Borg, 2012; Hagedoorn et al., 2019). Notably, both examples pertain to water quality; none have addressed agri-environmental stewardship schemes. Given the power and relevance of CE to address AES design, financing and agri-environmental policy challenges that would be contextually appropriate for SIDS, the stark hole in the literature relevant to this matter in Caribbean, African and Pacific SIDS needs to be addressed.

To address this gap, our study seeks to answer three research questions: (1) What are the agri-environmental services that tax-payers value most? (2) What are the main drivers of AES participation for taxpayers? (3) Is the willingness to pay (WTP) for AESs enough to justify their implementation in SIDS? As such the contribution of this article to the literature is three-fold. Firstly, it provides empirical evidence on the design and implementation a climate-sensitive AES in SIDS. Secondly, it delivers policy options to contextually inform actual public policy. Lastly, methodologically we highlight the role of virtual choice experiments in augmenting this process. The goal of such a pursuit is to determine the role and impact of agri-environmental policy attributes on WTP and adoption rates to facilitate a well-informed policy decision on the implementation of an AES. This is to ensure it is implemented in a manner that would improve agri-environmental stewardship and climate change adaptation within a small island developing state. An AES of this nature could potentially reduce direct transfers to the agricultural sector, create fiscal space through a sustainable financing mechanism and contribute to the climate change adaptation and mitigation under the Nationally Determined Contributions to the UNFCCC.

Our study utilizes virtual choice experiments (VCE) to evaluate the dynamics of WTP to maintain a traditional agricultural landscape with improved AES within the small island developing state of Barbados. The Government of Barbados considers agriculture to be one of the nation's potential growth drivers and stimulates it through a combination of incentives and concessions to agricultural producers, high border protection, and support to research and infrastructure (Shik et al., 2019). Support to producers in Barbados averaged 33.4 % of gross farm receipts in 2012-2014, and the significant share of that support (38 %) was provided in the form of transfers to general services (Shik et al., 2019). Total transfers arising from agricultural policy reach 1.1 % of the national GDP (Shik et al., 2019). The majority of this funding currently provided directly to non-sugar producers is done through the agricultural incentive scheme (AIS). Specifically, this support is provided in the form of rebates on purchases made by farmers that align to government policy as outlined within the AIS. The Ministry of Agriculture has considered redirecting producer support through the national AIS into an AES programme that would facilitate improved soil and water management, reduce the use of synthetic chemicals, maintain the agricultural landscape, and facilitate climate change adaptation.

For the purpose of this research we utilize a VCE to elicit the preferences of taxpayers within the case study area. We allow participants to choose between two alternative AES programmes that contain a number of similar attributes but at different levels. Adhering to the recommendation of Adamowicz, Louviere and Swait (1998) a non-choice option or opt-out choice was also provided to prevent a forced choice and to facilitate normal choice behaviour. Respondents were asked to select their preferred AES programme with its associated attributes and cost rather than a blanket opportunity to state their WTP. This approach reduces the opportunity for protest and warm glow responses that could artificially push WTP down or up.

The article proceeds as follows. First, we undertake a brief review of relevant Agri-environmental Schemes and WTP Studies. Subsequently, a description of the case study area and its main characteristics are provided. Then the VCE theoretical framework is elaborated and the associated methodology for its design, implementation and analysis is outlined. Finally, the results of the VCE are analyzed and discussed in manner that facilitates the distillation of policy implications in the conclusion of the research findings.

5.2. Background

5.2.1 Agri-environmental Schemes

Agriculture globally is struggling to simultaneously produce healthy food for a growing population while regulating its impacts on the environment and society (Sukhdev, 2018). These impacts in many cases are both negative and positive non-market externalities (Sandhu et al., 2019). Some positive environmental externalities include biodiversity support, capturing of greenhouse gases and pollutants in the air, water quality control, soil erosion prevention and carbon sequestration (Macháč et al., 2020). In the absence of the internalization of these positive externalities, an under provision of these public goods will occur. If the public values the provision of public goods within the agricultural sector and is willing to pay for it, then a public policy aimed at its protection is justified (Cooper et al., 2009). AES under the EU Common Agricultural Policy (CAP) have been the main public policy instrument to correct used to address the under provision of positive externalities and reduce negative externalities within the agricultural sector (Cullen et al., 2018).

Environmental stewardship within the agricultural sector has traditionally fallen under the umbrella of Agri-environmental policy and a common mode of achieving these goals is the utilization of AES. Fresco and colleagues (2016) noted that although food safety was the dominant concern among consumers at the onset of the Common Agricultural Policy, concerns relating to the environment are becoming increasingly important for EU citizens. AESs offer payments to farmers for effective land management to protect and enhance the environment and wildlife. Batary and colleagues (2015) have meticulously highlighted the development and expansion of these schemes from in the late 1980s and 2010s across Europe. The increase sensitivity of the general public to the non-market values of agriculture has led Howley and colleagues (2012) to postulate that under future Common Agricultural Policy reform it may be the case that farmers will be paid more for conservation activities rather than for the security of food production.

AES also aim to improve climate resilience of the agricultural sector, contributing to climate change adaptation and mitigation (Keenleyside et al., 2011; Macháč et al., 2020). Olsen (2007) made strong arguments for why policies to support adaptation and mitigation should be closely linked to the development of AES. Two of the main reasons provided are: 1) Climate change enhances some of the current negative environmental effects of agriculture and create new ones, 2) climate change may threaten some of the traditional low-intensity farming systems, which are

critical to nature conservation and protection of the rural environment. For the past decade climate change adaptation and mitigation have been a part of the overarching objectives of AES. Yet, to date AES have been commonly applied in large and rich countries, with little evidence existing on the applicability of AES in SIDS.

5.2.2 Effectiveness of Schemes

The generalization of the effectiveness of the European agri-environmental schemes is not possible since the result of comprehensive studies to date have yield mixed results (Auditors and Union, 2011; Pe'er et al., 2017; Dupraz and Guyomard, 2019). However, there are very specific studies that provide various views on the effectiveness of such schemes in Europe with reference to specific components of the scheme under examination. For example, the experience in Europe has demonstrated the AES can be effective for conserving wildlife on farmland, but they must be appropriately designed and targeted as these schemes have proven expensive (Batáry et al., 2015). The evidence to support the benefits of AES in relation to flooding is relatively sparse, there is some evidence that targeting specific grips/areas may help to reduce flooding from upland areas (Lane et al., 2003). There is robust evidence that the schemes made a significant contribution to the protection of historic and landscape features (Boatman et al., 2008). There is also some evidence that supports the positive impact on habitat protection (Critchley et al., 2004).

Notably, there are several case studies in Europe that have proven some schemes to be ineffective due to poor targeting and design (Boatman et al., 2008). Therefore, although these schemes have the potential to be effective, without the appropriate contextual design AES can be ineffective and detrimental to their own cause. This is supported by Strauss and colleagues (2007) who conclude that a fundamental factor that will determine the effectiveness of any land management practice or mitigation method is its relevance to the situation.

5.2.3 WTP Studies on Agri-environmental Landscapes & Services

Most WTP studies in the literature both generally and specifically as it relates to the WTP for agri-environmental landscapes and services have utilized Contingent Valuation (CV) as opposed to choice experiments (CE) as the main method for valuation. This was so up until the first decade of the 21st century, after this period there has been a rapid increase in the use of choice experiments within the literature (Birol and Koundouri, 2008). CE can be applied to address the issues of AES design and adoption rates. Yes, even of more relevance within context of fiscally constrained SIDS is the ability of CE to concomitantly inform the public policy decision to initiate the implementation of an AES by identifying the financing mechanism that would sustain the scheme. Given the power and relevance of CE to address AES design, financing and agri-environmental policy challenges that would be contextually appropriate for SIDS, the stark hole in the literature relevant to this matter in Caribbean, African and Pacific SIDS needs to be addressed.

There are only a few examples in the literature that sought to utilize CE to address environmental issues within SIDS (Hess and Beharry-Borg, 2012; Hagedoorn et al., 2019). Both studies pertained to water quality; none have addressed Agri-environmental stewardship schemes. To address this gap, our study utilizes VCE to evaluate the dynamics of WTP to maintain a traditional agricultural

landscape with improved agri-environmental and climate change adaptation services within the small island developing state of Barbados. Determining the WTP of the public could justify utilizing this WTP as a sustainable financing mechanism if the value of the WTP exceeds the cost of the AES. This is an essential step if direct taxation is to be considered as a financing mechanism for the AES since WTP studies have demonstrated that WTP in several cases has been lower than the cost of implementing the AES. Specifically, one of the first non-market valuation studies applied to agriculture to elicit WTP conducted by Drake in 1992 concluded that the Swedish aggregated WTP was not enough to maintain traditional farming landscapes in their mountainous regions. Jin et al (2017) found in relation to pesticide related health risk that the marginal WTA for the same risk change is about two times higher than the marginal WTP. Meta-analysis of the WTP/WTA provide evidence of this disparity and various rationales that would support these disparities (Horowitz and McConnell, 2002; Sayman and Öncüler, 2005). These studies demonstrate the importance of capturing the WTP from the target populations before designing and implementing an AES finance by taxpayers that would require the target population to exceed their WTP (Santos et al., 2016; Tienhaara et al., 2020). At the same time, a large number of WTP studies in the literature that are relevant to AES reveal WTP values that exceed the cost of implementing the AES. Some examples include Campbell et al. (2006) whose results from a discrete CE showed that WTP for the landscape benefits of the Rural Environment Protection Scheme in Ireland alone exceeded the average cost of the scheme across the Irish adult population. The highest WTP values were found for preserving ‘rivers and lakes’ and ‘wildlife habitats’ which was followed by ‘cultural heritage’, ‘mountain land’, ‘farmyard tidiness’, ‘stonewalls’, ‘pastures’ and ‘hedgerows’ Campbell et al. (Campbell et al., 2006). Overall WTP for the environmentally sensitive area policy that preserves traditional Scottish agriculture was calculated at £107.55 per household per year by Hanley et al. (1998). Both Santos (1998) and Madureira (2006) have demonstrated that the Portuguese society has a very high WTP for landscape preservation. These results imply the importance of ascertaining both WTP and WTA relative to the proposed AES.

5.3 Methodology & Theoretical Framework

5.3.1 Model Specification

In this study the conditional logit model is employed utilizing Random Utility Theory to model an individual's choice among a choice set of agri-environmental policy attributes. The Random Utility Theory has already been used in the literature to value environmental policy attributes (Tan et al., 2018; Hilger et al., 2019; Muringai et al., 2020). In this framework, given a finite set of alternative policy options characterized by distinct agri-environmental scheme attributes, the individual n chooses the policy option i that provides the highest utility U . According to the Random Utility Theory, the utility of the goods or service, in our case the agri-environmental policy, is the sum of a deterministic component, V_{in} , and a random component, ε_{in} . Therefore, the general model can be specified as a stochastic conditional (conditional on the choice made) indirect utility function of the form:

$$U_{in} = V_{in} (y_n - P_i, Z_i, C_n; \beta) + \varepsilon_{in} \quad i = 1, 2, 3, \dots, I \quad n = 1, 2, 3, \dots, N \quad (1)$$

where y_n is income of a household n , P_i is the tax payment made by taxpayers for the policy choice option i , Z_i is a vector of observed policy attribute(s), C_n is a vector of observed individual characteristics and β is a parameter vector. The probability that individual n chooses policy i rather than policy j is

$$P_n(i) = P(V_{in} (y_n - P_i, Z_i, C_n; \beta) + \varepsilon_{in} \geq V_{in} (y_n - P_j, Z_j, C_n; \beta) + \varepsilon_{jn}) \quad (2)$$

Assuming that the random component follows an *i.i.d.* extreme value type I distribution, then the probability that individual n chooses policy i can be written in a logit model of the following form:

$$P_n(i) = \frac{\exp(\mu V_{in})}{\sum_{j=1}^I \exp(\mu V_{in})} \quad (3)$$

where i is the number of policy choice options, and μ is a scale parameter, which is usually assumed to be equal to one. Expression [3] is the basic equation of a conditional logit (Greene, 2003). In this CE a conditional logit model used; this means that we assume that the values of the choice characteristics vary across choices, while the parameters are common across the choices. In this case, the social and economic characteristics of the taxpayers are constant across choices for any given taxpayer; they can only enter the model as interaction terms with the policy attributes. See for instance the studies by Chattopadhyay (2005) and Earnhart (2001). The conditional indirect utility function, V_{in} , considered in this study is assumed to be linear in parameters.

$$V_{in} = \beta_0 + \beta_y(y_n - P_i) + \beta_1 Z_{1i} + \beta_2 Z_{2i} + \dots + \beta_h Z_{hi} \quad (4)$$

The conditional logit model is estimated using the maximum likelihood estimation method. Once the model parameters are estimated and assuming constant marginal utility of the income, a welfare measure can be estimated. For instance, for a taxpayer n facing a choice set i the expected compensating variation (CV) can be computed using the following expression:

$$E(CV) = \frac{\ln \sum_i \exp(V_{i1}) - \ln \sum_i \exp(V_{i0})}{\gamma} \quad (5)$$

where $--$ represents the constant marginal utility of income, and V_{i1} and V_{i0} represent indirect utility functions after and before the change considered in the choice experiment. Moreover, the estimated coefficients can be used to estimate the marginal cost of each attribute which, is equal to the marginal willingness to accept for that attribute. The marginal WTP for a change in a single attribute can be represented as a ratio of coefficients:

$$MWTP = -1 \left(\frac{\beta_{attribute}}{\gamma} \right) \quad (6)$$

CV and MWTP are used as inputs into the simulation and evaluation taxpayers' participation within the AES based on the policy attributes and income tax contributions to the programme. The option of considering the change in the probability of participating in the AES due to a change of the level in one or more policy attributes pursued using the logit probability. The logit probability of choosing alternative i rather than alternative j is given by:

$$P_i = \left(\frac{e^{\beta x_i}}{\sum e^{\beta x_j}} \right) \quad (7)$$

5.3.2 Data Collection

To elicit taxpayers' preferences for the policy attributes we conducted a survey among taxpayers in Barbados between February and March 2020 using face-to face interviews with 96 residents of Barbados. The most recent 2010 Barbados National Census data was used to achieve a nationally representative quota-controlled sample (GOB, 2010). The quota sampling approach was utilized to capture from the target populations persons aged 18 and above within specified demographic groups. The total population of Barbados was estimated at 279,569 with the agricultural sector constituting 3.8 % of the GDP of Barbados and 2.9 % of its jobs (Shik et al., 2019). The survey was aligned with the national agricultural strategic plan and administered with the support of both Ministry of Agriculture and Ministry of Environment. The fact that the survey was linked to the actual foreseen policy rather than a hypothetical CE assured made respondents more willing to participate.

5.3.3 VCE Survey Design & Application

Virtual reality (VR) can be described as dynamic, computer-generated 3D environments (Harrison et al., 2011). VR is known to be more engaging than static images (Bateman et al., 2009). Phillips and Marsh (2015) note that while computer generated 3D environments have been used for decades in computer games or building design, their use in non-market valuation is more recent and still limited. According to Hughes et al., (2004) VR injects more realism in economic experiments and facilitates a move away from the highly focused and abstracted environment that has become synonymous with such experiments. The incorporation of VR within a CE is expected to reduce asymmetry of gains/losses according to Bateman and colleagues (2009). Additional benefits of utilizing VR CE include: reducing idiosyncratic choice error, increasing Stated Choice Certainty, reduce the Frequency of status-quo choices, reduce Left-right bias in choice experiments and reduce Scope insensitivity (Phillips and Marsh, 2015). Therefore, this approach was applied to our research.

Specifically, the VR environment is designed by using the real 3D landscape of traditional agricultural lands in Barbados. The development of the VR Agri-environmental landscapes was achieved using ERDAS IMAGINE software. ERDAS IMAGINE is an image processing software package that allows users to process both geospatial and other imagery, it handles vector data, hyperspectral imagery, and LiDAR. Firstly, the terrain and land-cover imagery of an existing agri-environmental landscape in the St. George Valley in Barbados that represents the status quo was developed using LiDAR (ECW file) provided by the Ministry of Environment (Figure 5.1).

Figure 5.1: AN AERIAL VIEW OF ST. GEORGE VALLEY, BARBADOS, UTILIZED FOR THE VIRTUAL REALITY-ENHANCED CHOICE EXPERIMENT TO REPRESENT THE STATUS QUO SITUATION.

Secondly, the image was draped unto the relief of the surface terrain of the St. George Valley by the use of VirtualGIS to match the image with the topography. Following this, we selected the final scene used in the survey, and determined a flight path over which a survey respondent would virtually travel during the CE. A recorded flight path demonstrated the changes in status quo by creating new housing structures, which were inserted within the 3D landscape. Moreover, we designed infographics of the CE attributes to accompany the VR scene and integrated them within the virtual flythrough of the landscape to demonstrate additional deviations from the status quo.

SAMPLE QUESTION - OPTION B

Figure 5.2: IMAGE OF VIRTUAL FLY-THROUGH THE REAL LANDSCAPE THAT INCORPORATES AGRI-ENVIRONMENTAL POLICY DESIGN CAPTURED IN NEW 3D OBJECTS AND IN ASSOCIATED CHOICE EXPERIMENT ATTRIBUTES THAT ARE INDICATED BY ICONOGRAPHICS BELOW.

The completed virtual scenarios were recorded and uploaded to YouTube to facilitate the flythrough of the landscape as seen in Figure 5.2 above. Although this same application could have easily allowed for interactive unconstrained virtual walks around these models, it was decided not to use this option in order to maintain a consistent experience by participants and experimental rigor. The virtual tours were designed to last approximately 30 seconds utilizing an aerial view that took survey respondents through the Valley from East to West. The recorded video of the tours was embedded into both the online and offline survey using the YouTube. A designate website host the CE and the survey with the accompanying virtual tours, which can be access via the following links: <http://dbynoe.troyweekes.com/> or <http://bit.ly/aesvirtualchoice> .

5.3.4 Attributes used in the Choice Experiment

Arriving at the appropriate attributes that are relevant to the context of the case study area could be challenging. This is especially true for AES policy designed since there exist a vacuum within the literature concerning agri-environmental attributes of interest to the general public with the exception of the aesthetics of the traditional sugar landscape. On the contrary, there are several local policy papers that highlight reduced use of synthetic chemicals, reduced soil erosion, increased rate ground water recharge, improved ground water quality and maintenance of the traditional agricultural/sugar landscape as important agri-environmental attributes from a policy perspective (Braithwaite, 2014). Once the traditional agricultural/sugar landscape is excluded, the degree to which these views are shared by the general public is uncertain. The aesthetics of the traditional sugar landscape is an integral part of the culture and heritage of Barbados and its importance has been recognized by the general public, policy makers and tourist.

Using the identified policy relevant attributes as a starting point, further qualitative research to refine the definitions of these attributes was carried out. Namely, Focus Group Discussions were conducted with general public and tourists in August 2016 to determine if the potential respondents viewed these attributes as relevant to agri-environmental stewardship in Barbados. The focus group discussions aimed to achieve local contextualization by determining the attitudes towards agri-environmental attributes and by eliciting background information on the main attributes and levels that would negatively or positively influence WTP. In addition, these discussions facilitated the identification of the attributes that were deemed as most important for both the local public and tourists. These discussions served as an opportunity to determine alternative approaches to the implementation of a CE payment mechanism that would be most realistic and appropriate for both respective parties. Five focus groups were conducted across Barbados to facilitate geographic spread and a wide cross section of perspectives. Table 5.1 reports the final set of the selected attributes, their description and relevant levels included in the survey.

Table 5.1: ATTRIBUTES AND LEVELS USED IN THE CHOICE EXPERIMENT TO ELICIT INDIVIDUAL WILLINGNESS TO PAY FOR AGRI-ENVIRONMENTAL SCHEMES IN SIDS BARBADOS

Scheme Attribute	Description	Attribute Level
Income Tax	The AES payment would take the form of an annual income tax deduction.	\$100 \$150 \$200
Use of Synthetic Chemicals	The quantity/percentage change of synthetic chemical used within the agricultural sector as a result of the AES.	20 % reduction 40 % reduction 60 % reduction
Soil Erosion	The quantity/percentage change of soil erosion within the agricultural sector as a result of the AES.	20 % reduction 40 % reduction 60 % reduction
Ground Water Recharge & Quantity	The quantity/percentage change in the ground water recharge/quantity within the agricultural sector as a result of the AES.	10 % increase 20 % increase 30 % increase
Traditional Agri-environmental landscape	The quantity/percentage change in the maintenance/deterioration of the traditional agricultural landscape as a result of the AES.	50 % maintenance 75 % maintenance 100 % maintenance

The survey instrument with embedded VR videos was refined using experts' judgment from technocrats within the Ministry of Agriculture. The pilot survey aided in the further refinement and subsequent finalization of the main survey questions. We also included questions to determine personal demographic information and their direct and/or indirect relationship with the agricultural sector and the environment. This included questions about age, gender, location, income, family status and involvement of themselves or relatives in the agricultural and environmental activities. In addition, respondents were also asked a series of questions aimed at revealing their attitudes towards the environment, the traditional Barbadian countryside and the agri-environmental stewardship activities being proposed by the actual policy design.

Utilizing CE applied to the selected attributes allows for the measuring of trade-offs between attributes that could be made to facilitate participation and the modification of WTP. Based on the five scheme attributes highlighted in the preceding table and the associated attribute levels, the possible combinations for the choices' sets are expansive. Therefore, JMP Version 12 software and the experimental design techniques outlined by Louviere and colleagues (2000) were employed to obtain a randomized orthogonal main effects design with 99.56 Chi2 Efficiency. Figure 5.3 presents an example of one of the choice cards that resulted from this design.

QUESTION

1 / 8

Which Agri-environmental Stewardship Programme option would you prefer to support?

Indicate your selection by clicking on your preferred choice.

	OPTION A	OPTION B	OPT OUT
	☐	☐	☐
Video			
Synthetic Chemicals	60% reduction	40% reduction	No change
Soil Erosion	60% reduction	40% reduction	No change
Ground Water	30% increase	20% increase	No change
Landscape Maintenance	100%	75%	No change
Income Tax	\$50	\$100	\$0

Figure 5.3: EXAMPLE OF THE AES PROGRAMME’S CHOICE CARD

To arrive at this final design, the criteria of maximizing D-Efficiency and A-Efficiency scores while minimizing the number of choice cards and correlation between were used. The goal of D-optimality to maximize the determinant of the information matrix, while A-optimality attempts to minimize the sum of the variances of estimated coefficients. The most optimal design achieved a high D-Efficiency (90.85) and A-Efficiency (82.30), fewer choice sets (8 choice sets per survey), and minimal correlation between factors. Two surveys were used, and two choice sets were employed to reduce the number of choice sets faced by each respondent from 16 to 8. Each choice set presented two programmes and an opt-out option.

5.4. Results & Discussion

5.4.1 Description of the respondents’ socio-demographic characteristics

The socio-economic and demographic characteristics of the survey respondents and the Barbados population in general are listed in Table 5.2. The sample is representative of the population except being slightly younger (29 years on average) and number of married respondents were higher. Within the sample the majority of respondents are male and the average household size of 3.56. The average household has an average income of \$4676.85 but the income range is wide.

Respondent with tertiary education within the sample are 54.6 % and the respondents generally had a good idea of what practices agricultural practices would contribute positively to agri-

environmental stewardship and adaptation. The majority of respondents believed that climate change was real. Most respondents stated that drought followed by higher temperatures are the most negative consequences of climate change are soil erosion, invasive pest and flooding respectively.

Table 5.2: SOCIO-ECONOMIC AND POPULATION CHARACTERISTICS

	Estimated National Census Data (2018), N= 279,569	Survey data (2020), N= 82		
		Mean	Standard Deviation	Range
Gender (% of Males)	51.7 %	56.8%	0.49	0 – 1
Age	38.9	29.39	14.51	0-65
Civil Status (% Married)	1.02 %	13.95 %	0.35	0-1
Size of Household	2.9	3.56	1.60	0-1
Education	65.43%	54.6 %	0.45	0-1
Household Income (\$/month)	-	4676.85	4169.43	0-20000

Table 5.3 lists the attitudes and previous environmental behaviour of the survey respondents. Respondents generally had confidence that if the programme was implemented (88.6 %) it would achieve its objectives of improving agri-environmental stewardship and climate change adaptation within the agricultural sector. The most important attribute within the AES programme was synthetic chemical reduction (Table 5.3). This was followed by the maintenance of the agricultural landscape, then the reduction of erosion and water quality improvement respectively. The attributes of least concern included the improvement of water quality and ground water recharge. The average respondent viewed agricultural landscape at least twice a week and engaged in approximately two activities relating to agriculture and the environment.

**Table 5.3: PREFERENCES & PREVIOUS AGRI-ENVIRONMENTAL
BEHAVIOUR
(PERCENTAGES AND MEAN VALUES)**

	Mean (in %)	Standard Deviation	Range
AES Practices Knowledge	6.28	2.55	1-8
Frequency of Agri-Landscape Immersion	2.08	1.46	0-4
Engagement in Agri-Environmental Activities	1.80	1.63	0-7
Climate Change Belief	98%	.15	0-1
Belief that AES Benefits are Delivered	89%	.32	0-1
<i>Most Negative Climate Change Impact</i>			
Flooding	7.9%	.27	0-1
Higher Temperatures	33%	.47	0-1
Pest	10 %	.30	0-1
Soil Erosion	13 %	.34	0-1
Drought			
<i>Most Important Attribute Rank</i>			
Landscape	2.58	1.64	0-5
Water	2.95	1.53	0-5
Chemicals	2.36	1.37	0-5
Erosion	2.67	1.38	0-5
Recharge	3.02	1.61	0-5
N	82		

5.4.2 Econometric Model Results

The conditional logit model for the population sample is presented in Table 6. The initial models contained all of the experiment's attributes and relevant case specific/individual variables. The Wald Chi-Squared Test was used to determine the significance of the model fit with reference to the explanatory variables. The Akaike information criterion (AIC) and Bayesian information criterion (BIC) were used to compare the regression models information criteria (IC) tests to determine the improvement of goodness of fit over the base model with only programme attributes. Both measures account for the goodness of fit of the models and their parsimony. While each measure penalizes a larger model for using additional degrees of freedom and rewarding improvements in goodness of fit, the BIC carries a higher penalty as degrees of freedom increases. The signs and magnitudes of the parameters in the model show the contribution of each variable relative to the individual's utility and probability of participating in the AES Programme. Therefore, larger positive coefficients increase the probability of participation while larger negative coefficients reduce the probability of participating given the parameter is significant within the model. Insignificant attributes do not improve or reduce individual utility and therefore will not impact participation within the AES programme.

Table 5.4: FACTORS INFLUENCING INDIVIDUAL PARTICIPATING IN THE AGRI-ENVIRONMENTAL STEWARDSHIP PROGRAMME

Attribute	Base Model			Final Model		
	Coef.	Std. Err.	P>Z	Coef.	Std. Err.	P>Z
Constant	.2788	.1140	0.014	.6870	.3311	.038
Synthetic Chemical Reduction	.0104	.0040	0.009	.0184	.0053	.000
Synthetic Chemical Reduction 40%				.2359	.1227	.055
Soil Erosion Reduction	.0076	.0039	0.052	.0076	.0043	.079
Ground Water Recharge	.0013	.0081	0.870	-.0364	.0163	.026
Ground Water Recharge 10%				-.6873	.3495	.049
Maintenance of Agri-Landscape	.0096	.0033	0.004	.0489	.0114	.000
Income Tax	- .0062	.0017	0.000	-.0085	.0023	.000
MAL*Education				-.0234	.0074	.002
MAL*Household Size				-.0058	.0024	.018
GWR*AE Group				.0360	.0167	.032
ITax*AE Group				.0055	.0031	.036
Household Income				.0000	.0000	.047
Agri-environmental Activities				.1488	.0615	.028
Maximum Income Tax				5.620	.2921	.092
AES Benefits Achievable				.4917	.3311	.038
Model Statistics						
No. of Observed Cases	1200			1130		
Model Fit (Wald Chi-Square)	38.75 (15) ***			70.50 (15) ***		
AIC	793.37			715.28		
BIC	819.75			784.87		

*Level of significance: * Significant at 90%; ** Significant at 95%; *** Significant at 99%*
Synthetic Chemical Reduction = SCR, Soil Erosion Reduction =SER, MAL = Maintenance of Agricultural Landscape, GWR = Ground Water Recharge & Quality, AE = Agri-Environmental, ITax = Income Tax

In Table 5.4 the final conditional logit model utilizes alternative specific constants and individual specific variables to account for the heterogeneity within the model. This improved the model fit in the subsequent models; however, the final conditional logit model offered the best fit. The results of the final model showed that synthetic chemical reduction, synthetic chemical reduction 40%, soil erosion reduction and maintenance of agricultural landscape are significant and positive. This indicated the probability of citizens participating in the AES programme increases if synthetic chemical reduction, soil erosion reduction and maintenance of agricultural landscape are a part of the programme. Income was significant and negative as expected, as income tax increased so does

the willingness to participate in the programme. Specifically, the probability of citizens willingly participating in the stewardship programme increased by approximately 0.6 % for the restricted model per dollar of additional income tax contribution required. The inclusion of synthetic chemical reduction within the AES programme increased the probability of citizen participation by 24 %; while the inclusion soil erosion reduction increases the probability of participation by .76 %. On the other hand, including the maintenance of the agricultural landscape increased the probability of citizen participation by 4.9 %. The inclusion of ground water recharge reduced the probability of willing participation by .36%. As education (2.3 %) and household size (.58 %) increased, respondents' utility for the maintenance of agricultural land diminished. Respondents who are members of an agricultural or environment group have a higher WTP (3.6 %) and derive a higher utility (.55 %) if ground water recharge is included within the programme. As household income, agri-environmental and maximum stated WTP increased the utility for participation within the programme also increased. Respondents who believe that the AES programme would achieve the stated benefits were 49 % more likely to participate in the programme.

Table 5.5: MEAN WTA FOR PROGRAMME ATTRIBUTES (C.I. 95%)

	Synthetic Chemical Reduction (income tax/1 % improvement /year)	Soil Erosion Reduction (income tax/1 % improvement /year)	Ground Water Recharge (income tax/1 %/year)	Maintenance of Agri- Landscape (income tax/1 %/year)
Final Model	\$2.17 (\$0.29 - \$4.06)	\$0.90 (-\$0.27 – \$2.06)	-\$4.30 (-\$9.01 - \$0.41)	\$5.76 (\$1.80 - \$9.73)

Table 5.5 shows the programme attributes and what citizens are willing to pay in income tax for a percentage improvement per year relative to each attribute. WTA for all attributes within the final model are positive except for the ground water recharge attribute. This demonstrated that respondents are on average not willing to pay for ground water recharge. Respondents are willing to pay for soil erosion reduction (\$0.90) but it constitutes the lowest among the remaining attributes within Table 5.5. Respondents are willing to pay the most for the maintenance of the agricultural landscape (\$5.76) followed by synthetic chemical reduction (\$2.17).

Table 5.6: PROGRAMME NON-COOPERATION RATES WITH SINGLE ATTRIBUTES (C.I. 95%)

Income Tax	Baseline	SCR ONLY	SER ONLY	GWR ONLY	MAL ONLY
\$ 50	21% (10-31 %)	20% (9-30%)	21% (10-31%)	23% (12-33%)	19% (7.6-29%)
\$ 100	40% (21-59%)	39% (20-59%)	40% (21-59%)	42% (23-60%)	38% (19-57%)
\$ 150	56% (33-79%)	56% (32-79%)	56% (33-79%)	57% (35-80%)	55% (31-78%)

The simulated AES Programme non-cooperation rate in Table 5.6 demonstrates that as expected higher income tax payments result in a higher percentage of respondents' not being willing to be involved in the programme. The inclusion of MAL within the programme offered the lowest level of non-cooperation while the inclusion GWR resulted in the highest level of non-cooperation regardless of the income tax payment. Within the simulation an income tax payment of \$ 50 and the inclusion MAL as single attribute offered lowest level of non-cooperation.

**Table 5.7: PROGRAMME NON-COOPERATION RATES WITH COMBINED ATTRIBUTES
(C.I. 95%)**

Income Tax	SCR + SER	SCR + GWR	SCR + MAL	SCR + GWR	SCR + SER + MAL	SCR + SER + GWR	SCR + GWR + MAL	SCR + SER + GWR + MAL
\$50	20% (9-31%)	22% (11-33%)	18% (7-29%)	22% (12-33%)	17% (6-28%)	21% (11-32%)	20% (9-31%)	19% (8-30%)
\$100	39% (20-58%)	41% (22-60%)	37% (18-57%)	41% (23-60%)	37% (17-57%)	41% (22-59%)	39% (20-58%)	39% (19-58%)
\$150	55% (32-79%)	57% (34-80%)	54% (30-78%)	57% (34-80%)	54% (29-78%)	57% (34-80%)	56% (32-79%)	55% (31-76%)

If more than one policy attribute is included in the AES programme, the highest level of participation (81%) or conversely the lowest level of non-cooperation (19%) is achieved by combining synthetic chemical reduction with the maintenance of the agricultural landscape (Table 7). An additional \$50 in income tax or total income tax payment of \$100 increases non-cooperation 19-20% above that of the income tax payment of \$50 for all combination of attributes. At this level of income tax there are four combinations that provide the lowest level of non-cooperation. Based on an estimated working population of 126,000 (Trading Economic, 2017) the income tax generated for the AES policy that included Synthetic chemical reduction and the Maintenance of the Agricultural Landscape at an income tax rate of \$50 would be \$6,300,000. When income tax generated is compared to the WTA (\$3, 495,400.00) by farmers to achieve 81% farmer participation in the AES as reflected in our previous study (Bynoe et al, 2020), it is clear that the WTP is almost twice as much as the WTA. The minimum payment feasible for the size of the taxable population (\$3, 495,400.00/taxable population) is approximately \$28 per year and would generate \$3,528,000.00 a non-cooperation rate of 3 % or 97 % voluntary participation.

5.5 Discussion

The results of the choice modelling analysis for the final model demonstrate that respondents' probability of participation increases if an AES offers a 40% reduction in synthetic chemical usage. In this case they are willing to pay \$2.17 per year for a one percent reduction in synthetic chemical usage. This is a large reduction and demonstrates the strong desire by the public to have a major shift in the way how their food is produced with regards to chemical usage. However, it is not surprising given that synthetic chemical reduction was identified by respondents as the most important attribute within the proposed AES programme. Barbados is one of the Caribbean islands that is particularly vulnerable to pesticide and chemical hazards due to its small size, limited human and financial resources and inadequate regulatory systems managing pesticide importation and use (Manten and Thomson, 2011). On average Barbadians are very concerned about the apparent high level of synthetic chemical usage within the agricultural sector. A social contract in the form of an AES programme provides citizens with an institutional channel to influence it.

The maintenance of the agricultural sector as a programme attribute also increases respondents' participation, is highly significant with an associated WTA of \$5.76 per year for each one percent of land maintained in agricultural production. This is consistent with the farmers ranking of maintenance of agricultural land as the second most important programme attribute by respondents. The maintenance of agricultural land has been a very contentious issue in Barbados for the last four decades. Since 1989 agricultural land has declined from 20,590 hectares to 7000 hectares in 2016 (GOB, 1989; Mundi, 2019). Barbadians have continuously voiced their concern about this, but there remains a national divide on this issue. Prominent politicians and business persons have argued that the land in Barbados should be put to the highest economic use (i.e. tourism and housing) while agricultural experts and environmentalists have argued that agriculture land preservation is important to maintain food security and for the agri-environmental services agricultural land provides. The results of the study reveal that though on average citizens are willing to pay to for the maintenance of the agricultural landscape as education (2.3 %) and household size (.58 %) increases the utility of preserving the landscape diminishes. The negative relationship with the increase in household size can be explained by the increase of demand for housing as household size increases. As Barbados modernized there is a move away from the extended family household to the nuclear family household (UNICEF, 2006), fuelling demand for the conversion of agricultural land into residential. Therefore, as house size increases families either pursue subdivision of agricultural family land to meet their additional need for housing or rely on developers who have or are in the process of converting agricultural land to housing. Zhou and colleagues (2020) show as educational level increases the affinity for agriculture and the utilization of land for agriculture declines. This correlation is evident from our analysis, given the negative coefficient for education and the willingness to maintain agricultural land.

Respondents have a relatively low positive utility for the inclusion of soil erosion reduction, this is consistent with the ranking of attributes with regards to perceived importance. This low utility may be associated the fact that only a small proportion of the Barbadian population are exposed to the direct impacts of soil erosion. Ali and colleagues (2014) demonstrate persons have a higher

utility to what they are directly impacted by. Most persons who are exposed to moderate and severe direct impacts of soil erosion reside in the Scotland District, this area only comprises 15 % of Barbados and is sparsely populated. The inclusion of ground water recharge results in a low negative utility for respondents. This low negative utility becomes more significant if only a 10% ground water recharge is provided within the AES programme. This aversion for payment for ground water recharge could be as a result of recently introduces direct taxes on water services that were intended to improve the quality of water services provided to the Barbadian public (GOB, 2018). Respondents may be of the opinion that not only are they paying already for this attribute, but they are paying more than they are willing to pay.

Members of Agricultural and Environmental organizations have a higher probability of participating in the AES programme if ground water recharge is included. They are also willing to pay more income tax for the programme. As individual income, maximum stated WTP and prior agri-environmental activity increase so does our respondents WTP, as is consistent with the literature (He et al., 2017; Peng et al., 2018; Ren et al., 2020). Respondents who believed that the AES programme would achieve the stated benefits were 49 % more likely to participate in the programme. This suggests that confidence and trust in the implementation of the AES programme is a major driver behind participation.

As reported in the literature (Peng et al., 2018), the simulated AES Programme non-cooperation rate demonstrates that higher income tax payments result in a higher percentage of respondents' not being willing to be involved in the programme. The inclusion of MAL within the programme offered the lowest level of non-cooperation while the inclusion GWR resulted in the highest level of non-cooperation regardless of the income tax payment. This was expected as these two attributes represent the opposite sides of the spectrum with regards to importance and probability of respondent participation spectrum. Within the simulations an income tax payment of \$ 50 and the inclusion MAL as single attribute offer the highest level of compliance.

Based on the results of our simulations, it appears that an income tax payment of \$50 or less with inclusion of the maintenance of agricultural land attribute is the ideal of the simulation options if the goal is to minimize policy attributes while maximizing willing participation in the programme by citizens. This combination ensures 81% voluntary participation. If the constraint for the formulation of the AES programme is to maximize policy attributes while maintaining the maximum level of voluntary participation, then by combining synthetic chemical reduction with the maintenance of the agricultural landscape is ideal. This combination also ensures 81% voluntary participation. An additional \$50 in income tax or total income tax payment of \$100 increases non-cooperation 19-20% above that of the income tax payment of \$50 for all combination of attributes. Although at this level of income tax there are four combinations that provide the lowest level of non-cooperation, the level of voluntary participation is 61% and the AES programme is not feasible at this level from the political perspective.

5.6 Conclusion

Small countries like SIDS share special structural and external challenges as recognized by the UN. These challenges are compounded by climate change and necessitates adaptation across the productive sectors in SIDS. The agricultural sector is one of the key sectors identified in most SIDS Nationally Determined Contributions as requiring the most urgent attention with regards to climate change adaptation and mitigation, calling for climate-resilience in agriculture. However, the limited fiscal space of most governments in SIDS constrains them from pursuing and financing AES that are appropriately designed to concomitantly improve environmental stewardship and facilitate climate change adaptation.

This study sought to determine the role and impact of key agri-environmental policy attributes relevant to SIDS on WTP and adoption rates to facilitate a well-informed policy decision on the implementation of an AES. Specifically: (1) What are the agri-environmental services that taxpayers value most? (2) What are the main drivers of AES participation for taxpayers? (3) Is the willingness to pay (WTP) for AESs enough to justify their implementation in SIDS? Our study represents the first non-market valuation study in SIDS utilizing virtual choice experiments to evaluate the dynamics of willingness to pay for an AES that aims to improve environmental stewardship and facilitate climate change adaptation. Importantly, our study provides the basis for the actual policy design, and hence prioritizes the realism of the choice experiment conducted. We clearly identify the main drivers the AES participation, the AES agri-environmental policy attributes most valued and the WTP by taxpayer for the implementation of the AES.

5.6.1 Implications for science:

The study shows that the maintenance of the traditional agricultural landscape and the reduction of synthetic chemicals are the agri-environmental services/attributed values most by taxpayers. Taxpayers are willing-to-pay the most for the maintenance of the traditional agricultural landscape, on average \$5.76 per year for each one percent of land maintained in agricultural production. The reduction of synthetic chemical usage has the second highest WTP, on average \$2.17 per year for a one percent reduction in synthetic chemical usage.

This study revealed that the AES policy adoption rate and WTP by taxpayers are driven by cognitive perception of the programme, previous agri-environmental behaviour and socio-economic characteristics of tax-payers that include belief that programme will deliver the promised benefits, education and agri-environmental group membership, level of engagement with the agri-environmental landscape, income levels and household size. With regards to cognitive perception, taxpayers who perceive that the benefits from the programme will be achieved have a higher probability of participation. Based on previous agri-environmental behaviour taxpayers who have a high level of agri-environmental engagement or are a member of agricultural/environmental group have a higher probability of participating within the AES and had a higher WTP. Finally, as it relates to socio-economic characteristics, members of larger households have a lower probability of participating in the programme with regards to the maintenance of the agricultural landscape attribute, this lower probability of participation concerning this attribute is also shared by local taxpayers who have obtained a tertiary education. In addition, local taxpayers who have either a

higher income or expressed a higher willingness to pay for the programme are more likely to participate within the AES.

The VCE methodology utilized in this study presents clear, concise, and easily replicable approach to the design of VCEs in small states where in many cases Lidar data is available to the Ministry of Agriculture or could be easily access via development funding. It provides a more realistic experience for respondents and increases stated choice certainty. In addition, it reduces asymmetry of gains/losses, idiosyncratic choice error, the frequency of status-quo choices, left-right bias in choice experiments and scope insensitivity.

5.6.2 Policy implications:

The results generally suggest that an AES to improve climate change adaptation and environmental stewardship would be embraced by the local population of Barbados, but the programme must be contextually designed to maximize voluntary participation. An AES programme designed in the context of a small island developing state like Barbados should have synthetic chemical reduction and the maintenance of the agricultural landscape as its two main attributes to encourage voluntary participation. To a lesser extent soil erosion reduction as an attribute within the programme also encourages participation. However, the inclusion of ground water recharge does not increase the probability of participation but rather diminishes it due to a decline a utility observed in this study. Taking this into consideration, from a public policy perspective if voluntary participation in the AES by the local taxpayer is to be achieved at an adoption rate equal to or exceed 80% while maximizing agri-environmental stewardship and climate change adaptation benefits then synthetic chemical reduction and the maintenance of the agricultural landscape attributes must be included within the AES at a maximum income tax rate between \$50. This would create sufficient fiscal space of \$6,300,000 to fund the AES based on the revealed WTA of local farmers which has estimated to cost \$3, 495,400.00 to achieve 81% farmer participation in the AES and will ensure that approximately 9,720 acres of agricultural land are enrolled in the programme. An agent-based model of these dynamics could provide greater resolution of the impact of the AES programme utilizing results of both the WTA and WTP studies of the AES. This would greatly inform the timeline for the actualization of the proposed agri-environmental and climate change adaption benefits. In addition, given that most SIDS are heavily dependent on tourism and tourist also benefit from the agri-environmental services from the agricultural sector a further study to gauge the WTP by tourist to support such an AES is recommended. Such a study could potentially identify an important resource base to finance the AES, reduce the tax burden on local taxpayers and improve social acceptability.

6. CHAPTER SIX: CONCLUSION

This body of work sought to explore, understand, and explain how macro-level climate change adaptation and environmental stewardship policy results emerge in Small Island Developing States from the micro-level behaviour of agents within the context of Multi-level Governance. The information derived from this research is aimed at facilitating improved climate change adaptation and environmental stewardship policy formulation and implementation, within the agricultural sector of Small Island Developing States (SIDS) influenced by multi-level governance structures. This concluding chapter addresses this matter and provides the answers to the main research questions that drove this body of work, as reflected in Chapter 1.

6.1 Overview of Findings

1.0 How does Multi-Level Governance (MLG) impact the climate change adaptation and environmental stewardship policy making process within the agricultural sector of a Small Island Developing State (Barbados)?

The impact of multi-level governance on climate change adaptation and environmental stewardship policy implementation within the agricultural sector of the Small Island Developing State of Barbados was addressed in Chapter 2. To explore the dimensions of this research question, Barbados was selected based on the lead role that it has played in international environmental governance, current policy demands within its agricultural sector and as a representative country of Caribbean SIDS. For the purpose of this study a systematic description of the relevant governance structures and climate policies at multiple levels was undertaken to facilitate the identification of the type of MLG present as categorized by Hooghe & Marks (2003) and its impact on climate change adaptation and environmental stewardship policy formulation and implementation with reference to the agricultural sector.

The results revealed that the predominant form of multi-level governance adopted in the small island developing state of Barbados at the national level since its independence in 1966 can be categorized as type 1. The adopted type 1 MLG structure and how it has been institutionalized has facilitated the deepening of MLG above the state level, made provisions for national level actors but has also presided over the under development of local government. This type of MLG has been described as largely being type 1 and has been characterized by a general-purpose governance approach, limited to four jurisdictional levels and a rather fixed system wide architecture. The extent to which MLG has been institutionalized has allowed multi-level governance actors at the national, regional, and international level to affect the discourse of the climate change adaptation and environmental stewardship policy debate and subsequent policy formulation in a very tangible way. Beyond the state, the regional and international actors have been the most influential and the state has facilitated this by voluntarily dispersing authority upward without reciprocating such dispersion downward. Thus, facilitating a deepening of MLG above the state. This has led to an imbalance in the MLG structure and the associated climate change adaptation policy. As a result of this supranational dominance, associated imbalance, and a deficiency in advocacy at the local level, climate change adaptation policy within the agricultural sector has not properly taken into

consideration the specific enabling conditions required at the local and community level. As a result, it has been conceiving climate change adaptation and environmental stewardship policies with spatial misfits. This has impeded the implementation of these policies at the local level, especially in local farming communities where tailored policies would be most beneficial and facilitate policy uptake where it is most required.

Despite this shortcoming the presence of MLG has facilitated the participatory development of generally inclusive broad-based CCA policies that address the needs of non-state actors. However, due to a lack of appropriate contextualization and means of implementation these needs, though reflected in the policy, are often not met. The type 1 structure without type 2 augmentation has not been the most effective type to MLG utilized to address climate change adaptation given the scope and nature of climate change. Merging the policy goals and objectives with the means to implement and the appropriate local level contextualization would improve climate change adaptation from the bottom-up.

2.0 Who are the main actors who influence climate change adaptation and environmental stewardship policy formulation inside the existing tiers of Multi-level Governance and how does the balance of power, cognition, motivation and accountability among the main actors impact the policy implementation process in a SIDS?

The main actors who influence climate change adaptation and environmental stewardship policy formulation inside the existing tiers of Multi-level Governance of SIDS are context specific. Within the context of Barbados, the results in Chapter 2 show that the main actors at the international level are the UN Organs and Institutions, Intergovernmental (e.g. AOSIS) and Government Entities and International CSOs. At the regional level the actors that dominate are CARICOM & Regional CSO. While at the national level the main actors are the Government and National CSOs, the main actors at the local level are just CSOs, so there is a stark absence of local government. The policy and debate on conducting the climate change and environmental stewardship policy that is specific to SIDS is strongly influenced and dominated at the top levels through supranational institutions such as AOSIS and CARICOM and is manifested at the International level through the UN SIDS Conferences and participation in the Climate Change COPs for example. The majority of such policy has been set at the international level but with significant participation and influence by supranational regional and national governance structures.

The national and regional levels are heavily dependent on the international administrative level for technical and financial support. This has been recognized at the international level and this dependency has been harnessed to incentivize implementation of international climate policies at the regional, national, and local levels. At the international level, issues concerning relations between the other levels of governance are strongly dictated by supranational actors such as the EU, regional intergovernmental groupings such as the AOSIS and transnational non-state actors. At the regional level the influence emanates from the cohesive policy direction of national governments/member states and regional non-state actors involved in governance at that level. While at the national level the national government largely influences and decides on the relationship with the other levels of governance.

The balance of power, cognition, and motivation among the main actors as it relates to their impact on the implementation of these policies within SIDS at the local level was explored in Chapter 3. Within the MLG context of this study, quantitatively applied contextual interaction theory demonstrates that community-based climate change adaptation policy implementation adequacy is driven/led by the most positive actor. If the most positive actor is the implementer, one must be cautious concerning overly zealous motivation on the part of the implementer as this may contribute to forced cooperation thus impacting the adequacy of implementation negatively. To maximize the adequacy of implementation it is important that the process is ultimately owned and driven from the bottom up by highly motivated target actors.

Furthermore, an imbalance in cognition between the target and implementer impacts negatively on adequacy of implementation. One should mind the gap as this is a major pitfall for implementation. However, this gap can be filled, and balance restored if both actors are positively motivated and active learning ensues. Therefore, with active cooperation and learning between actors' cognition is not divided and weighted separately but rather unified and shared among actors. In this way deficiencies in cognition in one actor are compensated for in the other actor. In contextual interaction theory accountability can possibly be incorporated within cognition. However, this study revealed the importance of placing special emphasis on measuring accountability separately and reducing the accountability gap between actors to improve adequacy of policy implementation. An imbalance in power between actors impacts implementation adequacy negatively if the implementer holds the balance of power. The temptation to pursue forced cooperation must be resisted by the implementer in the seat of power since such action is likely to lead to the implementation of policy in a manner that lacks contextualization to the target's needs, capacity and available resources at the local level.

3.0 What role does agri-environmental policy factors such as spatial relevance, demographic and geographical specific payment strategies play in determining the agri-environmental stewardship behavioural choice process of actors and farmers?

In Chapter 4 the role that agri-environmental policy factors play in determining farmer participation in an agri-environmental stewardship scheme was explored. The results demonstrate that spatial relevance determines the probability of farmers participation and is determined by the location of the production zone. The production zone location influences the probability of participation and therefore it is possible to offer specific differentiated geographical payments to increase the probability of participation within the two different production zones identified within this study. To increase the probability in production Zone 1 higher payments will be required. With regards to socioeconomic factors the most relevant were income and previous environmental behaviour. Farmers who view soil conservation as most important, use some form of organic fertilizer and practice water conservation, are more likely to participate in the AES programme. These revealed preferences suggest that farmers who are more environmentally conscious are more likely to participate in the programme. Farmers who view renewable energy as important are more likely to be involved in the AES programme if renewable energy and protected agriculture is offered as attributes.

3.1 What are the specific agri-environmental stewardship policy attributes and associated willingness-to-accept (WTA) that drive farm environmental stewardship and climate change adaptation behaviour?

Chapter 4 addresses the potential behavioural changes in Farm Environmental Stewardship in relation to the specific attributes and different levels of monetary incentives of the agri-environmental stewardship policy. The results demonstrate that the specific agri-environmental stewardship policy attributes that drives farm environmental stewardship and climate change adaptation are protected agriculture and sound soil & water management. The inclusion of both attributes within the AES positively influences behavioural change towards participation. Farmers have a high probability of participation and are willing to accept a payment \$163.89 per acre/year for an AES programme with soil and water management. Protected agriculture as a programme attribute also resulted in a high probability of farmers participation and a WTA of \$185.78 per acre/year in the restricted model. The maximization of farmers' participation once both soil and water management and protected agriculture are included depends on the level of payment provided. A payment of \$100 will provide 68% participation while a payment of \$200 will provide 80 % participation. The lowest marginal cost to maximize farmers' behavioural change within the simulations performed is \$150 per acre.

4.0 What is the Willingness-To-Pay (WTP) to maintain the agricultural landscape of Barbados with improved agri-environmental services?

The Willingness-To-Pay (WTP) to maintain the traditional agricultural landscape of Barbados with improved Agri-Environmental Stewardship utilizing a Virtual Choice Experiment (VCE) is explored in Chapter 5. The results of the choice modelling analysis for the final model demonstrate that respondents are willing to pay \$5.76 per year for each one percent of land maintained in agricultural production and \$2.17 per year for a one percent reduction in synthetic chemical usage. The maintenance of the agricultural land as a programme attribute also increases the probability of the respondents' participation.

Based on the results of simulations it appears that an income tax payment of \$50 with the inclusion of the maintenance of the agricultural landscape attribute is the best simulated option if the goal is to minimize policy attributes while maximizing participation in the programme by citizens. This combination ensures 81% voluntary participation. If the constraint for the formulation of the AES programme is to maximize policy attributes while maintaining the maximum level of voluntary participation, then by combining synthetic chemical reduction with the maintenance of the agricultural landscape is ideal. An additional \$50 in income tax or total income tax payment of \$100 increases non-cooperation 19-20% above that of the income tax payment of \$50 for all combination of attributes. The resulting level of voluntary participation is 61% and in this format the AES programme is not feasible from a political perspective.

4.1 To what degree can farmers' WTA driven by the AES policy be supported by Taxpayers' WTA and how does this relate to MLG?

The combination of Chapter 5, 4 and 2 address the degree to which farmers' climate change adaptation and agri-environmental stewardship can be supported by Taxpayers and how does this

relate to MLG. The results demonstrate that the inclusion of the maintenance of agricultural land and synthetic chemical reduction within the AES policy at an income tax rate between \$50 and \$ 28 would achieve a voluntary taxpayer's participation rate equal to or exceed 80%. This would create sufficient fiscal space to fund the AES to actualize policy goals and objectives based on the revealed WTA of local farmers which has been estimated to cost \$ 3, 495,400.00 if 9720 acres of agricultural land are enrolled in the programme.

Merging the policy goals and objectives with the means to implement and the appropriate local level contextualization would improve climate change adaptation from the bottom-up within the existing MLG structure. However, as a result of supranational dominance, associated imbalance, and a deficiency in advocacy at the local level, climate change adaptation policy within the agricultural sector has not properly taken into consideration the specific enabling conditions required at the local and community level. Thus, it has led to the conceiving of climate change adaptation policies with spatial misfits due to a lack of appropriate contextualization and means of implementation. The ability and willingness of taxpayers to pay for the AES addresses the imbalance and deficiency within the current MLG structure and resulting policy formulation and implementation inadequacy in three ways. Firstly, it demonstrates that local level actors could contextualize CCA and ES in a way that brings utility to them, thus avoid a potential policy misfit. Secondly, it addresses one of the most pressing issues that impedes policy implementation in SIDS: access to financial resources. Finally, it gives additional power to local actors to dictate the desired outcome of the CCA and AES policy thus addressing some of the imbalance within the current MLG structure with regards to CCA and ES policy. Therefore, there is an increase in power "resources", advocacy, and accountability at the local and national level of the MLG structure.

Overarching Question/ Main Research Question

What is the impact of Multi-level Governance on climate change adaptation and environmental stewardship policy in Small Island Developing States?

This research clearly demonstrates that the presence of MLG as in the case of Barbados has led to a weakening of governance below the state and a voluntary dispersal of power and authority above the state particularly as it relates to climate change adaptation and environmental stewardship policy. My research shows that this imbalance has led to the development of policies dominated by supranational perspectives and lacking appropriate local contextualization. Thus, it has led to conceiving climate change adaptation and environmental stewardship policies with spatial misfits that lack contextualization and the resources to adequately implement them. As a result Governments within SIDS continue to look above the state for the resources to implement these policies but this can lead to increased maladaptation as the resources often come with predefined notions of adaptation and stewardship as guided by their motivations (objectives). My research clearly demonstrates that it is possible to achieve local contextualization of the CCA and ES policies while ensuring that the resource GAP can be filled by local taxpayers if they are willing to pay as much or more than the cost of adaptation. This modality if applied according to the methodology used in this study not only allows for the local contextualization of the adaptation policy and provides the appropriate resources to facilitate implementation but it also mitigates the dispersal of power and authority above the state and increases accountability at the local level.

This would ultimately improve the adequacy of implementation of climate change adaptation and environmental stewardship policy in Small Island Developing States that face these similar challenges.

6.1 Policy Implications

The apparent type 1 MLG structure without type 2 augmentation has been shown not to be the most effective for the purpose of addressing climate change adaptation at the local level given the scope and nature of climate change impacts. As a consequence, central government should strongly consider deepening the MLG structure below the state through the creation of a legitimate local level government with some degree of institutional depth, policy scope, fiscal autonomy, representation, law making, executive control, fiscal control and coconstitutional reform authority. This approach would allow for the appropriate local level contextualization of policy goals and objectives. In addition, it can potentially provide the resource base to facilitate local level climate change adaptation and environmental stewardship. There is scope for this to be applied to other SIDS that have been found to have type 1 MLG structure without type 2 augmentation.

Within many SIDS a common problem is policy implementation. Often policies are evaluated at the later stages of implementation but at this stage the adjustments required to improve the adequacy of implementation often appear insurmountable. Governments and supranational organizations should incorporate modalities that more accurately measure and increase the motivation, cognition, power, and accountability of the policy target at various stages of the policy implementation process. This should be an integral part of their monitoring, evaluation, and management framework.

SIDS may be falsely classified as being too small to accommodate geographical specific payments aimed at maximizing AES participation. My research shows that such policy should be seriously explored even in the smallest of SIDS. Specifically, in the case of Barbados, government should consider reimagining the existing agricultural incentive scheme and instituting an AES that facilitates geographic specific payments based on established production zones. This would assist in the maximization of the farmers adoption rates and result in the behavioural changes most needed in the specific production zone to improve climate change adaptation and environmental stewardship. Consistent with these objectives, a national AES programme within the context of Barbados should include soil and water management and protected agriculture as this combination ensures a high farmers' adoption rate.

Policy makers must be cognizant that the maximization of farmers participation once both soil and water management and protected agriculture are included, depends on the level payment provided and the farmers previous environmental behaviour. An increase of training opportunities provided through the Ministry of Agriculture, and training institutions within the area of climate change adaptation and environmental stewardship should be an integral part of future policy as this influences farmers 'perception of associated practices, increases participation of farmers in the AES and reduces the overall cost of farmers' participation within the AES.

The results generally suggest that an AES to improve climate change adaptation and environmental stewardship would be embraced by the local population of Barbados. The government therefore

has a strong case to justify such a policy, especially if the AES is contextually designed to maximize voluntary participation. To achieve such an AES programme within the context of a small island developing state like Barbados, it should include synthetic chemical reduction and the maintenance of the agricultural landscape as its two main attributes for the maximization voluntary participation to occur. Fiscal space constraints that have in the past inhibited the pursuit of AES implementation could be pursued based on the demand from the public for the services provided by the AES. Therefore, the financing of an AES from taxpayers is a feasible policy option for the government of Barbados since the WTP adequately covers the WTA. An AES income tax provides a perfect and palatable vehicle to generate this fiscal space and farmers are willing to accept payments via a reduction in land tax. This provides a double dividend for government.

The contextual nature of policy makes it clear that each SIDS that intends to develop and implement climate change adaptation and environmental stewardship within the agricultural sector should undertake an appropriate behavioural analysis. Such an analysis will ensure that: the policy attributes included within the policy developed maximizes motivation and voluntary participation from key actors, the cognition gaps are addressed, and the appropriate resources are available to support climate change adaptation and environmental stewardship within the agricultural sector.

6.3 Research Strengths, Limitations & Future Work

This study has made an innovative contribution to the literature by translating contextual interaction theory, a qualitative, theoretical framework into a quantitative model that has been uniquely applied to model climate change adaptation and environmental stewardship policy implementation in SIDS. Furthermore, the quantitative model disembeds accountability from cognition to improve modelling predictability. The strength of this approach is the ability to proactively identify and modify key parameters within the model at an early stage to facilitate an improvement in the adequacy of implementation before implementation has been completed. In addition, this study utilizes cutting edge technology and geoinformatics to create a virtual choice experiment that allows for immersion by respondents within the agri-environmental space being evaluated. The methodology developed for the utilization, VCE, allows for the ease of replication by Ministries of Environment and Agriculture without the need for technical experts within the area. The research conducted in this study is also unique in its application in SIDS, it is based on real world policy needs and is fully endorsed by key stakeholders involved in the formulation and implementation of the climate change and environmental stewardship policies examined.

Notwithstanding these strengths, the research has a number of limitations that could be addressed in future work. These limitations include: the lack of inclusion of separate WTP analysis for tourists, the absence of agent-based modelling for the full systems analysis, small sample size with reference CIT and conditional logit modelling. Firstly, the inclusion of a separate analysis of tourist WTP could potential enlarge the fiscal space available to policy makers given that the number of tourists that visit the majority of SIDS are at least double the local population and they benefits from the agri-environmental services of the agricultural sector. In the case of Barbados, the tourist population is four times the local population. Secondly, the reduction in Variance Inflation Factor for several parameters within the CIT quantitative model could have been reduced through a larger sample size. Thus, reducing the need for the exclusion of some parameters within the restricted model. Similarly, within the choice experiments, a larger sample size could have

facilitated a random parameter model as opposed to the fixed effects model that better suited the relatively small sample size. Finally, Agent-based Modelling (ABM) could have been integrated with the choice experiment results to simulate the results of the CIT analysis given specified changes in policy factors.

Although the sample size from which this model was derived sufficiently representative of CBA projects within the larger portfolio, the model could benefit significantly from a larger sample size. This would increase the predictive power of the model and mitigate the need for the exclusion of the key target motivation variables due to micronumerosity. Therefore, I recommend that further research work addressing this matter should seek to include all projects within the CBA portfolio to enhance the prediction powers and reliability of the model. In addition, this quantitative approach to CIT should be tested further on adaptation at various scales, as this study was only focused on adequacy of adaptation policy implementation at the local level. What happens when implementation occurs at the national or regional level, is CIT still a balancing act?

In addition, given that most SIDS are heavily dependent on tourism and tourists also benefit from the agri-environmental services from the agricultural sector, a further study to gauge the WTP by tourists to support such an AES is recommended. Such a study could potentially identify an important resource base to finance the AES, reduce the tax burden on local taxpayers and improve social acceptability. An agent-based model of these dynamics could provide greater resolution of the impact of the AES programme utilizing results of both the WTA and WTP studies of the AES. This would greatly inform the timeline for the actualization of the proposed agri-environmental and climate change adaption benefits. Addressing the limitations, I outlined, would illuminate the path for future research work in this area.

This thesis represents a small but consequential contribution towards the understanding and explanation of how macro-level climate change adaptation and environmental stewardship policy results emerge in Small Island Developing States from the micro-level behaviour of agents within the context of Multi-level Governance. Its strong policy relevance and alignment will ensure that this research work directly contributes to shaping the foundation of real policy design and implementation in Barbados, and as such presents a good example of how scientific work can be used to develop data-driven policy and improve policy implementation.

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APPENDICES

Appendix A: Measuring the Operationalization of MLG

Scoring system taken from: (Hooghe et al., 2010)

Institutional Depth

- 0: no functioning general-purpose administration at the regional level;
- 1: a deconcentrated, general-purpose, administration;
- 2: a non-deconcentrated, general-purpose, administration subject to central government veto;
- 3: a non-deconcentrated, general-purpose, administration not subject to central government veto.

Policy Scope

- 0: the regional government does not have authoritative competence over economic policy, cultural educational policy, or welfare state policy;
- 1: the regional government has authoritative competence in one of the following areas: economic policy, cultural-educational policy, welfare state policy;
- 2: the regional government has authoritative competencies in at least two of the following areas: economic policy, cultural-educational policy, welfare state policy;
- 3: the regional government meets the criteria for 2 and is endowed with at least two of the following:
 - Residual powers
 - Regional police force
 - Authority over local government;
- 4: the regional government meets the criteria for 3, and has authority over immigration or citizenship.

Fiscal Autonomy

- 0: the central government sets the base and rate of all regional taxes;
- 1: the regional government sets the rate of minor taxes;
- 2: the regional government sets the base and rate of minor taxes;
- 3: the regional government sets the rate of at least one major tax: personal income, corporate, value added, or sales tax;
- 4: the regional government sets the base and rate of at least one major tax: personal income, corporate, value added tax, or sales tax.

Assembly

- 0: the region has no regional assembly;
- 1: the region has an indirectly elected regional assembly;
- 2: the region has a directly elected assembly.

Executive

- 0: the regional executive is appointed by central government;
- 1: dual executives appointed by central government and the regional assembly;
- 2: the regional executive is appointed by a regional assembly or is directly elected.

Fiscal Autonomy

0.5 is scored for each of the following characteristics. Aggregate scores range between 0 and 2:

- regions are the unit of representation in the legislature, i.e. the distribution of representation is determined by weights, rather than “one citizen, one vote” in the country as a whole;
- regional governments designate representatives in the legislature;
- regions at a given level have majority representation in the legislature;^a
- a legislature with regional representation has extensive legislative authority, i.e. it can veto ordinary legislation or it can be overridden only by a super majority in the other chamber.^a

^aevaluated if at least one of the first two conditions is met.

Executive Power Sharing

- 0: no routine meetings between central government and regional governments to negotiate policy;
- 1: routine meetings between central government and regional governments without legally binding authority;
- 2: routine meetings between central government and regional governments with authority to reach legally binding decisions.

Fiscal Control

- 0: regional governments or their representatives in the legislature are not consulted over the distribution of tax revenues;
- 1: regional governments or their representatives in the legislature negotiate over the distribution of tax revenues, but do not have a veto;
- 2: regional governments or their representatives in the legislature have a veto over the distribution of tax revenues.

Constitutional Reform

0: the central government and /or national electorate can unilaterally change the constitution;

1: a legislature based on the principle of regional representation must approve constitutional change; or constitutional change require a referendum based on the principle of equal regional representation (i.e. approval in a majority of regions);

2: regional governments are a directly represented majority in a legislature which can do one or more of the following:

- postpone constitutional reform
- introduce amendments
- raise the decision hurdle in the other chamber
- require a second vote in the other chamber
- require a popular referendum

3: a majority of regional governments can veto constitutional change.

Self-Rule

1: Self-rule refers to the authority of a regional government over those living in the region.

0: Authority government co-exercised over those living in the region.

Share Rule

1: Shared rule refers to the authority a regional government (co-)exercises in the country as a whole.

0: Authority government not co-exercised over those living in the region.

Appendix B: Community Adaptation Survey Questionnaire & Scoring

1. How was this decision to implement the project initiated?

This question is designed to provide basic background information about the project, and the interviewee may also indicate the initiator (see question 2).

2. If not addressed above, who initiated the process?

This response indicates power, as the initiator may have some formal control within the process. If the actor is named by either interviewee as the initiator, they receive one power point. A point may be gained but not lost for this question. More specifically, an actor does not lose a point if they did not initiate the process.

3. Does your organization require regulatory approval before implementing this?

This response indicates power, or a loss of power.
If the actor requires regulatory approval a point is lost, they receive one power point. If they do not, then a point is gained.

4. If yes, from what agency?

This provides additional informal concerning who hold regulatory power.

5. Is your organization responsible for providing regulatory approval before this can be implemented?

This response indicates power, as area use may experience.
If the actor is named by either interviewee as a user of the area, they receive one power point. As with question two, a point may be gained but not lost for this question.

6. If yes, for what groups or agencies?

This provides additional information for question 5.

7. Who are the primary users of the area?

This response indicates power, as area users may experience some informal control.
If the actor is named by either interviewee as a user of the area, they receive one power point. As with question two, a point may be gained but not lost for this question. More specifically, an actor does not lose a point if they are not a user of the area.

8. Can you name other actors or stakeholders involved?

This response deals with information if he or she can name other stakeholders the interviewee gains one point for having knowledge of actors and their qualifications. This answer also indicates power, as stakeholders have informal control within the process. If this actor is indicated as a stakeholder by any interviewee, he/she gains one point.

9. Has your organization worked with some of these groups or stakeholders in other projects in the past?

- ☐ yes
- ☐ no

This response reveals a source of power, specifically informal control. For this question I choose to conceptualize cooperation as an indicator of a lack of control. In contrast, a lack of cooperation with other groups or stakeholders indicates a source of control. This question touches on past cooperative behaviour. An answer of yes yields the interviewee the loss of one power point. An answer of no earns the interviewee one power point.

10. Do you anticipate working with any of these groups in the future on other projects?

- ☐ yes
- ☐ no

This response reveals a source of power, specifically informal control. For this question I choose to conceptualize cooperation as an indicator of a lack of control. In contrast, a lack of cooperation with other groups or stakeholders indicates a source of control. This question touches on the likelihood of future cooperative behaviour. It is not necessary that the interviewee actually works in the future with the other stakeholders on a project, only that the interviewee sees this as a possibility. If the interviewee anticipates working with the other actor(s) in the future, they have an interest in promoting cooperative behaviour. In consequence, if both see future cooperation as a possibility the result is comparatively neutral. An answer of yes yields the interviewee the loss of one power point. An answer of no earns the interviewee one power point.

11. How involved in this decision were these actors?

This answer indicates power relating to formal control. The answer to this question may give concrete information about who makes decisions within the process, or how actors share decision-making responsibilities. It may provide information as to whether one or a few actors lead the process, whether decisions are made by formal voting, informal consensus or some other method.

12. Would you describe any of these stakeholders as being targeted by this project (positively or negatively)? For example, if the project is implemented who has the most to gain and who has the most to lose?

For this response, the interviewee ideally indicates the target, and how the interviewee feels about that actor and their goals. Specifically, own motivation of the interviewee for the project implementation as it relates to their attitude towards the target groups.

If interviewee displays a positive attitude toward the target group, and the target is against implementation, minus one motivation point.

If interviewee displays a negative attitude toward the target group, and the target is against implementation, plus one motivation point.

If interviewee displays a positive attitude toward the target group, and the target is for implementation, plus one motivation point.

If interviewee displays a negative attitude toward the target group, and the target is for implementation, minus one motivation point.

For this response, the interviewee may also indicate whether their own motivation is compatible with the implementer's goals, though this topic is not addressed directly until question .

If the interviewee reveals their motivation is compatible with implementation, he/she gains one motivation point.

If the interviewee reveals their motivation is not compatible with implementation, he/she loses one motivation point.

13. What were the goals of this project?

This response may provide further evidence to support the response for question 12, as interviewees often reveal their own motivation for or against the implementer's goals while describing project goals. If interviewees have already revealed their own motivation compatibility with implementation in question 12, no points are gained or lost for this response.

If this information was not revealed in question 12, and interviewees are now for the first time revealing this information:

- 14a. Does your organization have goals for climate change adaptation in the area?
☐ yes
☐ no

If interviewees reveal their motivation is compatible with implementation, they gain one motivation point.

If interviewees reveal their motivation is not compatible with implementation, they lose one motivation point.

This answer can also provide background information about the details of the project.

- 14b. If yes, what are these goals?

Provides further information about the project.

15. Does your job usually include decisions about climate change adaptation projects?

☐ yes

☐ no

This question indicates any work-related motivation the respondent may or may not have toward climate change adaptation projects.

The respondent gains a point if they indicate their job enables climate change adaptation projects.

The respondent loses a motivation point if they indicate that halting or limiting climate change adaptation projects are a part of their job.

16. Does this project contribute directly or indirectly to your organization's goals?

☐ yes

☐ no

This response indicates work-related motivation for the project.

If implementation contributes to the goals of the individual's organization a positive motivation point is gained.

If implementation does not contribute to the goals of the individual's organization a motivation point is lost.

17. What is your personal position regarding the project goals?

	1	2	3	4	5	
positive	☐	☐	☐	☐	☐	non-positive

This answer indicates own motivation, specifically as it relates to the respondent's attitude to the implementation objective.

If the respondent is positive about the implementation project, he/she gains a motivation point.

If the respondent is not positive about the implementation project, he/she loses a motivation point.

18a. Do you find climate change adaptation an important part of climate change policy in general?

☐ yes

☐ no

This answer indicates own motivation, specifically as it relates to the respondent's attitude to the implementation objective.

If the respondent is supportive of wetland restoration in general (even if not in this specific case), she/he gains a motivation point.

If the respondent is not supportive of wetland restoration in general, she/he loses a

motivation point.

18b. Do you feel it is your civic duty to participate in this climate change adaptation project?

☐ yes

☐ no

This answer indicates own motivation, particularly normative motivation for the implementation.

If respondents feel that participation in the restoration is their civic duty, they gain a motivation point.

If an individual feels it is their civic duty to halt the project, they lose a motivation point.

If respondents do not feel that participation in the restoration (whether they have pro- or anti-restoration sentiments) is their civic duty, no points are gained or lost.

19. Did other actors in the region get involved with this project?

☐ yes

☐ no

This response may indicate a source of own motivation; specifically, it seeks to understand if there is any social pressure to comply with the implementation.

A response of yes yields a positive motivation point if it indicates social pressure from actors pushing for implementation.

A response of yes yields the loss of a motivation point if it indicates social pressure from actors who are against implementation.

A response of no indicates a lack of social pressure and receives no points.

20a. Did politicians support this project?

☐ yes

☐ no

This response may indicate a source of own motivation; specifically, it seeks to understand if there is any political pressure to comply with the implementation.

A response of yes yields a positive motivation point if it indicates political pressure from politicians pushing for implementation.

A response of yes yields the loss of a motivation point if it indicates political pressure from politicians who are against implementation.

A response of no indicates a lack of political pressure and receives no points.

20b. If yes, were they local, regional, provincial, or national?

This response provides details to enhance understanding of political pressure for or against implementation, as well as providing evidence to support a response of yes to question 20a. It does not offer points for or against the motivation score.

21a. Do you find climate change adaptation presents a risk to your community?
☐ yes
☐ no

This question seeks to understand the own motivation of the actor more fully, specifically, his or her attitude toward the implementation objective. In general, does the interviewee find climate change is a risk to the community, regardless of their perception of this specific project?

An answer of yes yields the loss of one motivation point.

The answer no results in gaining one motivation point.

21b. If yes, where do you find this risk come from?

This question seeks to provide clarification for the answer to 16a, however it does not offer points for or against the motivation score.

22a. Do you find climate change adaptation benefits your community?
☐ yes
☐ no

This question seeks to understand own motivation of the actor more fully, specifically, his or her attitude toward the implementation objective. In general, does the interviewee find that climate change adaptation benefits the community, regardless of their perception of this specific project?

An answer of yes results in a gain of one motivation point.

The answer no results in losing one motivation point.

22b. If yes, where do you think this benefit comes from?

This question seeks to provide clarification for the answer to 22a, however it does not offer points for or against the motivation score.

23a. Do you find climate change presents a risk to your local community?
☐ yes
☐ no

This question seeks to understand own motivation of the actor more fully, specifically, his or her attitude toward the implementation objective. In general, does the interviewee find climate change a local threat?

An answer of yes results in a gain of one motivation point, however no points are lost for a response of no.

24b. Do you find climate change presents a risk to your country?
☐ yes
☐ no

As with question 24a. this question seeks to more fully understand own motivation

of the actor, specifically his or her attitude toward the implementation objective. In general, does the interviewee find climate change a national threat?

An answer of yes results in a gain of one motivation point, however no points are lost for a response of no.

25. Was this project important to your community?

☐ yes

☐ no

This response may indicate a source of own motivation; specifically it seeks to understand if there is any normative pressure to comply with the implementation. It may indicate whether the project has some value within the community.

A response of yes yields a positive motivation point if the community is pushing for implementation.

A response of yes yields the loss of a motivation point if the community is against implementation.

This question may also elicit information about potential economic motivation within the community for the project, which influences the interviewee's own motivation.

A response indicating that the project has economic value within the community yields a positive motivation point.

A motivation point is not lost if the interviewee fails to indicate that the project has economic value within the community.

26. Was the community at large involved in this decision?

☐ yes

☐ no

This response may indicate a source of own motivation; specifically it seeks to understand if there is any social pressure to comply with the implementation.

A response of yes yields a positive motivation point if the community is pushing for implementation.

A response of yes yields the loss of a motivation point if the community is against implementation.

A response of no may indicate no social pressure in relation to the project.

27. If yes, was community involvement part of the formally required process, or was it informal?

In a general way this response gives details about how community members might have been included in the process, and if included whether this was via formal or informal channels. This provides evidence to support the response to question 26. However, no points are gained or lost for this aspect.

This answer may also reveal a source of own motivation, for example if an actor has used formal or informal routes to express motivation for or against the adaptation.

If such a source of motivation is revealed and is pro-adaptation, a motivation point is gained.

If such a source of motivation is revealed and is anti-adaptation, a motivation point is lost.

This response may also give details about whether inclusion in the process indicates a source of power. For example, has any group used informal channels such as the media or a coalition of partners to build power for their cause?

If such a source of power is revealed a power point is gained.

28. Did you use informal channels such as lobbying or outreach to build support during this project?

This identifies informal power.

29. If yes, did this support lead to a change in the situation for stakeholders?

This identifies informal power.

34. Do you believe other actors used informal channels such as lobbying or outreach to build support during the project?

This identifies informal power.

34. Were other actors dependent on resources that you could make available for them?

This identifies informal power.

35. If the community became involved, how do you feel about community involvement?

This response may indicate a source of own motivation; specifically, it seeks to understand if there is any social pressure to comply with the implementation.

A response in favour of community involvement yields a positive motivation point if the community is pushing for implementation.

A response in favour of community involvement yields the loss of a motivation point if the community is against implementation.

A response against community involvement yields the loss of a motivation point if the community is pushing for implementation.

A response against community involvement yields a gain of a motivation point if the community is against implementation.

A response indicating that there is no social pressure to follow the community's wishes yields no gain or loss in points.

36. How important is it to you that community members are satisfied with the results?

This response may indicate a source of own motivation; specifically, it seeks to understand if there is any social pressure to comply with the implementation.

A response indicating the necessity of community satisfaction yields a positive motivation point if the community is pushing for implementation.

A response indicating the necessity of community satisfaction yields the loss of a motivation point if the community is against implementation.

A response indicating that it is not a necessity to explicitly satisfy the community as a whole yields no gain or loss in points.

37. What is the policy or programme supporting this climate change adaptation project?

This question reveals cognition level, specifically the actor's policy awareness.

If the actor is aware of the policy being applied in this case, he/she gains a cognition point.

If the actor is unaware of the policy being applied in this case, he/she loses a cognition point.

38. Are the requirements for this policy clear to you?

☐ yes

☐ no

This question reveals cognition level, specifically the actor's knowledge of policy requirements.

If the actor knows the requirements of the policy being applied in this case, he/she gains a cognition point.

If the actor is unaware of the requirements of the policy being applied in this case, he/she loses a cognition point.

39. Is your organization responsible for seeing that policy requirements are fulfilled?

☐ yes

☐ no

This question reveals cognition level, specifically the actor's knowledge of policy requirements.

If the actor knows the requirements of the policy being applied in this case, he/she gains a cognition point.

If the actor is unaware of the requirements of the policy being applied in this case, he/she loses a cognition point.

This response reveals a source of power, specifically formal responsibility for the implementation.

If the respondent shares in responsibility for the implementation, he or she gains a power point.

If the respondent does not share in responsibility for the implementation, he, or she

loses a power point.

40. Does implementing this policy bring benefits to your organization?

☐ yes

☐ no

This question reveals cognition level, specifically the actor's knowledge of policy benefits.

If actors are aware of policy benefits, they gain a cognition point.

As this question does not necessarily consider whether there are in fact benefits, when actors are unaware of policy benefits, they do not lose any points.

This question also reveals a source of work-related motivation

The respondent gains a motivation point if implementation brings benefits to their organization.

The respondent loses a motivation point if implementation does not bring benefits to their organization.

41. How would you describe the information your organization receives about this adaptation policy program?

	1	2	3	4	5	
accessible	☐	☐	☐	☐	☐	not accessible

This question reveals cognition level, specifically the level of accessibility in information received by this actor.

If the response reveals there were no problems in accessibility, a cognition point is gained.

If the response reveals there were problems in accessibility, a cognition point is lost.

This response also reveals issues of documentation in information received by this actor.

If the response reveals there were no problems in documentation, a cognition point is gained.

If the response reveals there were problems in documentation, a cognition point is lost.

42. How was this project funded?

This question reveals cognition in terms of knowledge of actors and their qualifications: specifically if the respondent is aware of funding was organization for the project, even in general terms.

If the respondent is aware of funding organization for the project, even in general terms, he, or she gains a cognition point.

The respondent loses no points for being unaware of funding arrangements.

This question may also indicate work-related motivation.

If the respondent's organization is fully or partially funding the project, they gain a

motivation point.

The respondent loses no points regarding motivation if their organization is not funding the project.

43a. During the decision-making process did you find yourself dependent on others for information?

☐ yes

☐ no

This question reveals cognition level, specifically the dependency of accessibility in information received by this actor.

If the response reveals there were no problems in accessibility, a cognition point is gained.

If the response reveals there were problems in accessibility, a cognition point is lost.

This response also indicates dependency regarding documentation in information received by this actor.

If the response reveals there were no problems in documentation, a cognition point is gained.

If the response reveals there were problems in documentation, a cognition point is lost.

43b. What are your impressions of this information in terms of quantity?

☐ no problems

☐ some problems

In addition to providing evidence to support the response to question 43a. this response gives details about the quantity of information received by this actor.

If the response reveals there were no problems with information quantity, a cognition point is gained.

If the response reveals there were problems with information quantity, a cognition point is lost.

43c. What are your impressions of this information in terms of quality?

☐ no problems with quality

☐ some problems with quality

In addition to providing evidence to support the response to question 43a. this response gives details about the quality of information received by this actor.

If the response reveals there were no problems with information quality, a cognition point is gained.

If the response reveals there were problems with information quality, a cognition point is lost.

44a. Did your organization assist others with advice or information during the process?

- ☐ yes
- ☐ no

This response reveals information level, specifically the level of accessibility in information provided by this actor.

If the response reveals this actor made materials accessible during the process, a cognition point is gained.

If the response reveals this actor failed to make materials accessible during the process, a cognition point is lost.

This response also reveals the level of documentation of information provided by this actor.

If the response reveals this actor provided documents during the process, a cognition point is gained.

If the response reveals this actor failed to provide documents during the process, a cognition point is lost.

45b. If so, how?

The answer to this question is intended to provide evidence to support question 45a.

46. During the project, did you find a lack of information existed between yourself and other actors?

- ☐ yes
- ☐ no

This question seeks to understand if lack of information became a problem during the project, first in reference to accessibility.

If the response is yes, the interviewee loses a cognition point. If the response is no, the interviewee gains a cognition point.

47. To whom is your organization accountable?

A point is gained for accountability if they can identify who they are accountable to.

48. For what is organisation accountable for?

A point is gained for accountability if they can identify what they are accountable for.

49. How would you rate the accountability of the main actor involved in the implementation of the project?

A point is lost from the other actor if their accountability is rated low.

50. Are there things you are uncertain about which hamper your activities regarding this project?

- ☐ yes
- ☐ no

This response deals with cognition, and should indicate any uncertainties that hold back the activities of the project. This may reveal whether process complexities became an issue.

If the response is yes, the interviewee loses a cognition point.

If the response is no, the interviewee gains a cognition point.

This answer may also reveal a source of own motivation, specifically self-effectiveness.

If the interviewee describes uncertainties that indicate a lack of confidence about implementation success, a motivation point is lost.

54. Who is in charge of monitoring the effects of this decision?

- ☐ your organization
- ☐ another organization

In assessing power, this response reveals whether the interviewee shares in responsibility for the project as a monitor of any changes made in implementation. If the respondent's organization is responsible for monitoring, a power point is gained.

If the respondent's organization is not responsible for monitoring, a power point is lost.

55. If applicable, how would you describe the monitoring program?

This question seeks details about the monitoring program, providing evidence to support the answer to question 54 and enriching understanding about this project.

56. What agency is responsible for reporting the results of this project?

- ☐ your organization
- ☐ another organization

In assessing power, this response reveals whether the interviewee shares in responsibility for the project as a reporter of the results of the project.

If the respondent's organization is responsible for reporting results, a power point is gained.

If the respondent's organization is not responsible for reporting results a power point is lost.

57. Are your organization's funds for implementing this project immediately available?

If the respondent's organization funds for implementing this project are immediately available, a power point is gained.

If the respondent's organization funds for implementing this project are not immediately available, a power point is lost.

58. Has the financial capacity of your own organization been a limiting factor in project implementation?

If the respondent's organization financial capacity is not a limiting factor to the project, a power point is gained.

If the respondent's organization financial capacity is a limiting factor to the project, a power point is lost.

59. Has a delay in resources been a limiting factor in project implementation?

If a delay in resources has been a limiting factor in project implementation, then a power point is lost.

If a delay in resources has not been a limiting factor in project implementation, then a power point is lost.

60a. Did this project involve financial commitment by your organization?

☐ yes

☐ no

This question seeks to understand what resources if any have been committed to the project by this actor. The response may reveal whether capacity in resources ever supported or hampered implementation.

This response may also reveal a source of power relating to formal responsibility due to financial contribution by the actor or his/her organization.

If the interviewee's organization contributed financially to the project, he/she gains a power point.

If the interviewee's organization did not contribute financially to the project, he/she loses a power point.

61b. Did this project involve an administration commitment by your organization?

☐ yes

☐ no

This question seeks to understand what resources if any have been committed to the project by this actor. The response may reveal whether capacity in resources ever supported or hampered implementation.

62c. Did this project involve a time commitment by your organization?

☐ yes

☐ no

This question seeks to understand what resources if any have been committed to the project by this actor. The response may reveal whether capacity in resources ever supported or hampered implementation.

63. Did your organization support the project in other ways?

This question seeks to understand any addition resources that may have been committed to the project by this actor. The response may reveal whether capacity in resources ever supported or hampered implementation.
Also, a source on information about informal channels of power if relevant. If such a source of power is revealed a power point is gained.

64a. Were there resources you needed but did not have access to during the project?

☐ yes

☐ no

This question seeks to understand whether a lack of resources was perceived as a problem by this actor within the process.

If the response is yes, a power point is lost.

A response of no yields neither a gain nor loss in points.

65b. For example, Legal assistance

☐ yes

☐ no

This question is used as a probe to ensure that the interviewee understands what type of responses I am seeking, and may encourage memory of an applicable resource that was lacking during the process. It also provides details about process interactions.

66c. For example, Organizational support

☐ yes

☐ no

This question is used as a probe to ensure that the interviewee understands what type of responses I am seeking, and may encourage memory of an applicable resource that was lacking during the process. It also provides details about process interactions.

67. During this process, if something is important to your group and others disagree, what do you think are the chances of attaining goals important to you?

☐ high chance

☐ low chance

This response reveals own motivation as it relates to actor self-effectiveness.

If the respondent is positive about their chances of attaining important goals, they receive a positive motivation point.

If the respondent is negative about their chances of attaining important goals, they lose a motivation point.

This question also seeks information about an aspect of power. Does this actor feel their organization can effectively convince other actors to agree to goals that they find important?

If the respondent is positive about their chances of changing the perspective of others to meet their own goals, they receive a power point.

68. How were decisions made about this project? (For example, by an environmental organization, via a committee of stakeholders?)

This response provides details about how decisions were made, enhancing general information about the process.

This answer may also reveal sources of formal control over the decision-making process.

69. Who do you think is viewed by the public as the group primarily responsible for this project?

This question seeks information about who is perceived by the public as the actor responsible for the project. This provides general details about the case.

70. How would you describe the overall process? (in a few words or a sentence)

This question seeks details about the interviewee's experiences during the project. It may reveal new information about motivation, information, or power.

71. Has any factor in this case diminished your motivation for the project?

If any factor diminished the motivation of the respondent, a motivation point is lost.

No motivation point was gained if there were no factors that diminished the motivation of the respondent.

72. Do you believe you can resolve this issue in the course of this project?

A motivation point is gained if the respondent believes or believed that any issue could have been resolved.

A motivation point is lost if the respondent believes or believed that any issue could have been resolved.

73. Do you think that this project was successfully implemented?

This provides a perception of adequacy of implementation.

74. How would you rate the adequacy of the adaptation methods implemented in achieving the stated goal(s) and objectives of the project?

This provides rating for adequacy of implementation.

75. What percentage of the adaptation methods were successfully implemented?

This provides percentage rating for adequacy of implementation.

76. What is the total change between the first VRA and the last VRA result?

This provides a change in VRA.

Appendix C: Willingness To Accept Questionnaire

The Government of Barbados is considering embarking on a programme to improve environmental stewardship and facilitate climate change adaptation within the agricultural sector.

Registered farmers who are willing to participate in this programme will be given an annual payment through the National Agricultural Incentive Scheme.

1. Environmental Stewardship & Climate Change Adaptation

Environmental stewardship refers to responsible use and protection of the natural environment through conservation and sustainable practices. Examples of environmental stewardship practices in agriculture include water and soil conservation such as contour ploughing and mulching. Climate change and environmental stewardship are directly linked.

Climate change is the long-term change in average weather conditions, including temperature, precipitation, and wind.

According to the United Nations Intergovernmental Panel on Climate Change (IPPC), which is comprised of the world's leading scientific experts in the field of climate change, our climate is undergoing dramatic changes as the direct result of greenhouse gas (GHG) emissions from human activity such as carbon dioxide and methane. GHG's are gases in the atmosphere that act like a glass roof around the earth, trapping in heat that would otherwise escape to space – this is commonly referred to as the “greenhouse effect”.

2. Impacts of Poor Environmental Stewardship Climate Change on the Agricultural Sector

A) Flooding B) Cane Fire C) Soil Erosion D) Drought E) Storm Event D) Livestock Heat Stress

Poor environmental stewardship within the agricultural sector can: reduce water quality due overuse of fertilizers and pesticides; reduce the rate of ground water recharge by neglect of field wells; increase soil erosions due to poor soil management; lead to the loss of biodiversity by focusing only on one crop; and negatively impact human health by the unsafe handling and use of pesticides and fertilizer during production.

Changes in mean rainfall and temperate as well as the increase in extreme climate events will affect agriculture, livestock, forestry as well as fisheries. Many climate impacts, such as increased land degradation and soil erosion, changes in water availability, biodiversity loss, more frequent and more intense pest and disease outbreaks as well as disasters can impact on the agricultural sector negatively and need to be addressed to ensure the future viability of the agricultural sector.

3. Environmental Stewardship and Climate Change Adaptation Benefits

B) Fabric Mulching B) Renewable Energy C) Protected Agriculture D) Water Harvesting E) Increased Farm Profitability D) Improved Water Quality

Appropriate environmental stewardship within the farming community can lead to: improved water quality through the reduction or exclusion of harmful chemicals and pesticides from the production system; reduced soil erosion and improve soil quality due

to good soil management; maintenance and enhancement of biodiversity through encouraging polyculture; and improved human health through reduced exposure to harmful pesticides and fertilizers.

Appropriate environmental stewardship coupled with adequate adaption to climate change facilitates the long-term economic sustainability of the agricultural sector. Adapting to climate change facilitates the long-term financial feasibility of individual farms since farmers can obtain improved harvests in times of adverse climactic conditions through more climate resilient production system. Adaptation that is relevant to the local context prevents further degradation of the environment due poorly/ill-adapted interventions and reduces social displacement within the agricultural sector.

4. Proposal to Participate

We would like to determine whether you are interested in being directly involved in the stewardship of your environment and on-farm climate change adaptation through participation in the following programme:

The Ministry of Agriculture is developing a programme to improve environmental stewardship and climate change adaptation within the agricultural sector. This programme will be funded through an international climate finance fund. Registered farmers who are willing to enrol and participate in this programme will receive the benefit of an annual environmental and climate stewardship payment applied to their land tax bill.

5. Description of Programme Payment & Commitments

Environmental and Climate Stewardship Payment: The payment will be annual and provided to registered farmers per acre of land enrolled within the programme depending on the level of compliance by the farmer to the programme.

Farmers who participate in the programme are expected to commit to at least four of the following activities:

- **Soil & Water Management**
- **Renewable Energy Utilization**
- **Protected Agriculture (at least 400 sqft per acre)**
- **Restricted and Reduced Synthetic Pesticide and Fertilizer use on Farm (at least 20% reduction)**
- **Organic Agricultural Practices**

Choice Cards Version 1:

1. Which option would you prefer for you to participate in the programme? Indicate your selection by placing an X within the box of your preferred choice.

PROGRAMME ATTRIBUTES	OPTION 1	OPTION 2
SOIL & WATER MANAGEMENT PRACTICES (Used As Recommended & Agreed)	No	Yes
PROTECTED AGRICULTURE USE	No	Yes
SYNTHETIC FERTILIZER AND PESTICIDE USE (Restricted & Reduced)	50%	40%
RENEWABLE ENERGY USE	No	Yes
REBATES (On all approved CCA & AES Practices)	30%	40%
ECO-LABEL	Yes	No
LAND TAX REDUCTION PER ACRE	\$ 150	\$ 200

Which option do you prefer?

☐

OPTION 1

☐

OPTION 2

☐

NONE

2. Which option would you prefer for you to participate in the programme? Indicate your selection by placing an X within the box of your preferred choice.

PROGRAMME ATTRIBUTES	OPTION 1	OPTION 2
SOIL & WATER MANAGEMENT PRACTICES (Used As Recommended & Agreed)	No	No
PROTECTED AGRICULTURE USE	Yes	Yes
SYNTHETIC FERTILIZER AND PESTICIDE USE (Restricted & Reduced)	30%	40%
RENEWABLE ENERGY USE	No	No
REBATES (On all approved CCA & AES Practices)	40%	40%
ECO-LABEL	Yes	No
LAND TAX REDUCTION PER ACRE	\$ 200	\$ 300

Which option do you prefer?

☐

OPTION 1

☐

OPTION 2

☐

NONE

3. Which option would you prefer for you to participate in the programme? Indicate your selection by placing an X within the box of your preferred choice.

PROGRAMME ATTRIBUTES	OPTION 1	OPTION 2
SOIL & WATER MANAGEMENT PRACTICES (Used As Recommended & Agreed)	No	Yes
PROTECTED AGRICULTURE USE	No	Yes
SYNTHETIC FERTILIZER AND PESTICIDE USE (Restricted & Reduced)	40%	30%
RENEWABLE ENERGY USE	Yes	No
REBATES (On all approved CCA & AES Practices)	30%	40%
ECO-LABEL	No	Yes
LAND TAX REDUCTION PER ACRE	\$ 200	\$ 150

Which option do you prefer?

☐

OPTION 1

☐

OPTION 2

☐

NONE

4. Which option would you prefer for you to participate in the programme? Indicate your selection by placing an X within the box of your preferred choice.

PROGRAMME ATTRIBUTES	OPTION 1	OPTION 2
SOIL & WATER MANAGEMENT PRACTICES (Used As Recommended & Agreed)	Yes	No
PROTECTED AGRICULTURE USE	No	Yes
SYNTHETIC FERTILIZER AND PESTICIDE USE (Restricted & Reduced)	30%	40%
RENEWABLE ENERGY USE	Yes	No
REBATES (On all approved CCA & AES Practices)	40%	40%
ECO-LABEL	Yes	No
LAND TAX REDUCTION PER ACRE	\$ 300	\$ 150

Which option do you prefer?

☐

OPTION 1

☐

OPTION 2

☐

NONE

5. Which option would you prefer for you to participate in the programme? Indicate your selection by placing an X within the box of your preferred choice.

PROGRAMME ATTRIBUTES	OPTION 1	OPTION 2
SOIL & WATER MANAGEMENT PRACTICES (Used As Recommended & Agreed)	Yes	Yes
PROTECTED AGRICULTURE USE	Yes	Yes
SYNTHETIC FERTILIZER AND PESTICIDE USE (Restricted & Reduced)	40%	30%
RENEWABLE ENERGY USE	Yes	No
REBATES (On all approved CCA & AES Practices)	40%	40%
ECO-LABEL	Yes	Yes
LAND TAX REDUCTION PER ACRE	\$ 200	\$ 300

Which option do you prefer?

☐

OPTION 1

☐

OPTION 2

☐

NONE

6. Which option would you prefer for you to participate in the programme? Indicate your selection by placing an X within the box of your preferred choice.

PROGRAMME ATTRIBUTES	OPTION 1	OPTION 2
SOIL & WATER MANAGEMENT PRACTICES (Used As Recommended & Agreed)	Yes	No
PROTECTED AGRICULTURE USE	Yes	No
SYNTHETIC FERTILIZER AND PESTICIDE USE (Restricted & Reduced)	40%	30%
RENEWABLE ENERGY USE	No	Yes
REBATES (On all approved CCA & AES Practices)	40%	30%
ECO-LABEL	Yes	No
LAND TAX REDUCTION PER ACRE	\$ 200	\$ 300

Which option do you prefer?

☐

OPTION 1

☐

OPTION 2

☐

NONE

7. Which option would you prefer for you to participate in the programme? Indicate your selection by placing an X within the box of your preferred choice.

PROGRAMME ATTRIBUTES	OPTION 1	OPTION 2
SOIL & WATER MANAGEMENT PRACTICES (Used As Recommended & Agreed)	Yes	Yes
PROTECTED AGRICULTURE USE	Yes	No
SYNTHETIC FERTILIZER AND PESTICIDE USE (Restricted & Reduced)	30%	50%
RENEWABLE ENERGY USE	Yes	No
REBATES (On all approved CCA & AES Practices)	40%	30%
ECO-LABEL	No	Yes
LAND TAX REDUCTION PER ACRE	\$ 150	\$ 300

Which option do you prefer?

☐

OPTION 1

☐

OPTION 2

☐

NONE

8. Which option would you prefer for you to participate in the programme? Indicate your selection by placing an X within the box of your preferred choice.

PROGRAMME ATTRIBUTES	OPTION 1	OPTION 2
SOIL & WATER MANAGEMENT PRACTICES (Used As Recommended & Agreed)	Yes	No
PROTECTED AGRICULTURE USE	No	Yes
SYNTHETIC FERTILIZER AND PESTICIDE USE (Restricted & Reduced)	40%	30%
RENEWABLE ENERGY USE	Yes	No
REBATES (On all approved CCA & AES Practices)	40%	30%
ECO-LABEL	Yes	No
LAND TAX REDUCTION PER ACRE	\$ 1	\$ 300

Which option do you prefer?

☐

OPTION 1

☐

OPTION 2

☐

NONE

Choice Cards Version 2:

1. Which option would you prefer for you to participate in the programme? Indicate your selection by placing an X within the box of your preferred choice.

PROGRAMME ATTRIBUTES	OPTION 1	OPTION 2
SOIL & WATER MANAGEMENT PRACTICES (Used As Recommended & Agreed)	No	Yes
PROTECTED AGRICULTURE USE	No	No
SYNTHETIC FERTILIZER AND PESTICIDE USE (Restricted & Reduced)	50%	30%
RENEWABLE ENERGY USE	Yes	Yes
REBATES (On all approved CCA & AES Practices)	30%	30%
ECO-LABEL	Yes	No
LAND TAX REDUCTION PER ACRE	\$ 300	\$ 200

Which option do you prefer?

☐

OPTION 1

☐

OPTION 2

☐

NONE

2. Which option would you prefer for you to participate in the programme? Indicate your selection by placing an X within the box of your preferred choice.

PROGRAMME ATTRIBUTES	OPTION 1	OPTION 2
SOIL & WATER MANAGEMENT PRACTICES (Used As Recommended & Agreed)	No	No
PROTECTED AGRICULTURE USE	Yes	Yes
SYNTHETIC FERTILIZER AND PESTICIDE USE (Restricted & Reduced)	40%	50%
RENEWABLE ENERGY USE	No	Yes
REBATES (On all approved CCA & AES Practices)	30%	30%
ECO-LABEL	No	No
LAND TAX REDUCTION PER ACRE	\$ 200	\$ 300

Which option do you prefer?

☐

OPTION 1

☐

OPTION 2

☐

NONE

3. Which option would you prefer for you to participate in the programme? Indicate your selection by placing an X within the box of your preferred choice.

PROGRAMME ATTRIBUTES	OPTION 1	OPTION 2
SOIL & WATER MANAGEMENT PRACTICES (Used As Recommended & Agreed)	No	No
PROTECTED AGRICULTURE USE	No	Yes
SYNTHETIC FERTILIZER AND PESTICIDE USE (Restricted & Reduced)	30%	40%
RENEWABLE ENERGY USE	Yes	No
REBATES (On all approved CCA & AES Practices)	40%	30%
ECO-LABEL	Yes	Yes
LAND TAX REDUCTION PER ACRE	\$ 200	\$ 300

Which option do you prefer?

☐

OPTION 1

☐

OPTION 2

☐

NONE

4. Which option would you prefer for you to participate in the programme? Indicate your selection by placing an X within the box of your preferred choice.

PROGRAMME ATTRIBUTES	OPTION 1	OPTION 2
SOIL & WATER MANAGEMENT PRACTICES (Used As Recommended & Agreed)	Yes	Yes
PROTECTED AGRICULTURE USE	No	No
SYNTHETIC FERTILIZER AND PESTICIDE USE (Restricted & Reduced)	50%	40%
RENEWABLE ENERGY USE	Yes	Yes
REBATES (On all approved CCA & AES Practices)	30%	40%
ECO-LABEL	No	Yes
LAND TAX REDUCTION PER ACRE	\$ 200	\$ 300

Which option do you prefer?

☐

OPTION 1

☐

OPTION 2

☐

NONE

5. Which option would you prefer for you to participate in the programme? Indicate your selection by placing an X within the box of your preferred choice.

PROGRAMME ATTRIBUTES	OPTION 1	OPTION 2
SOIL & WATER MANAGEMENT PRACTICES (Used As Recommended & Agreed)	Yes	No
PROTECTED AGRICULTURE USE	No	Yes
SYNTHETIC FERTILIZER AND PESTICIDE USE (Restricted & Reduced)	50%	40%
RENEWABLE ENERGY USE	No	Yes
REBATES (On all approved CCA & AES Practices)	40%	30%
ECO-LABEL	No	Yes
LAND TAX REDUCTION PER ACRE	\$ 150	\$ 150

Which option do you prefer?

☐

OPTION 1

☐

OPTION 2

☐

NONE

6. Which option would you prefer for you to participate in the programme? Indicate your selection by placing an X within the box of your preferred choice.

PROGRAMME ATTRIBUTES	OPTION 1	OPTION 2
SOIL & WATER MANAGEMENT PRACTICES (Used As Recommended & Agreed)	Yes	No
PROTECTED AGRICULTURE USE	No	Yes
SYNTHETIC FERTILIZER AND PESTICIDE USE (Restricted & Reduced)	50%	40%
RENEWABLE ENERGY USE	No	Yes
REBATES (On all approved CCA & AES Practices)	40%	30%
ECO-LABEL	No	Yes
LAND TAX REDUCTION PER ACRE	\$ 150	\$ 200

Which option do you prefer?

☐

OPTION 1

☐

OPTION 2

☐

NONE

7. Which option would you prefer for you to participate in the programme? Indicate your selection by placing an X within the box of your preferred choice.

PROGRAMME ATTRIBUTES	OPTION 1	OPTION 2
SOIL & WATER MANAGEMENT PRACTICES (Used As Recommended & Agreed)	No	Yes
PROTECTED AGRICULTURE USE	Yes	No
SYNTHETIC FERTILIZER AND PESTICIDE USE (Restricted & Reduced)	50%	40%
RENEWABLE ENERGY USE	Yes	No
REBATES (On all approved CCA & AES Practices)	30%	40%
ECO-LABEL	Yes	Yes
LAND TAX REDUCTION PER ACRE	\$ 150	\$ 150

Which option do you prefer?

☐

OPTION 1

☐

OPTION 2

☐

NONE

8. Which option would you prefer for to participate in the programme? Indicate your selection by placing an X within the box of your preferred choice.

PROGRAMME ATTRIBUTES	OPTION 1	OPTION 2
SOIL & WATER MANAGEMENT PRACTICES (Used As Recommended & Agreed)	No	No
PROTECTED AGRICULTURE USE	No	Yes
SYNTHETIC FERTILIZER AND PESTICIDE USE (Restricted & Reduced)	30%	50%
RENEWABLE ENERGY USE	No	No
REBATES (On all approved CCA & AES Practices)	30%	40%
ECO-LABEL	No	No
LAND TAX REDUCTION PER ACRE	\$ 300	\$ 200

Which option do you prefer?

☐

OPTION 1

☐

OPTION 2

☐

NONE

9. In your opinion, the preceding questions were:

- ☐ Clear
- ☐ Not so Clear
- ☐ Confusing

10. Which of the following factors you considered as most important? Number your answers in order of preference with 1 being the most preferred.

Restriction & Reduction of Synthetic Fertilizer & Pesticide Use	☐
Renewable Energy	☐
Water Conservation & Management	☐
Soil Conservation & Management	☐
Protected Agriculture	☐

11. Which of the following factors are you least likely to implement? Number your answers in order of preference with 1 being the least likely.

Restriction & Reduction of Synthetic Fertilizer & Pesticide Use	☐
Renewable Energy	☐
Water Conservation & Management	☐
Soil Conservation & Management	☐
Protected Agriculture	☐

12. What is the principal reason that would cause you to participate in this programme?

13. If this programme starts next year will you participate?

- Yes ☐ Maybe Yes ☐ Maybe No ☐ No ☐

14. If you indicated no in question 13, how much compensation per acre would be required to get you to participate in the programme? \$ _____

15. If you will participate how many acres would you enter into the programme?

All ☐

If otherwise, please indicate _____

16. What is the maximum period that you are willing to be contracted to participate in this programme?

☐ 5 Years

☐ 10 Years

☐ 15 Years

17. In your production zone/area what is the most important issue? Revise and put this in data as a dummy.

Drought ☐

Soil erosion ☐

Flooding ☐

Pollution of water quality ☐

Overuse of Chemicals ☐

Water Conservation & Management

18. Do you currently practice water-harvesting?

Yes ☐ No ☐

19. If yes, please state the type of water harvesting practiced. If no go to question 19.

20. Do you practice water conservation?

Yes ☐ No ☐

21. If yes, please identify the water conservation strategies used?

☐ Drip irrigation Mulch ☐ Soil Tensiometers ☐

Soil Conservation & Management

22. Do you currently practice contour ploughing?

Yes ☐ No ☐

23. Do you plant a buffer zone on the hedge row to prevent soil erosion?

Yes ☐ No ☐

24. Do you add additional source of soil organic matter?

Yes ☐ No ☐

25. Do you practice mulching?

Yes ☐ No ☐

26. What other soil conservation and management techniques used that are not included about?

Renewable Energy

27. Do you use renewable energy on your Farm? and if so what type of renewable energy?

Yes ☐ No ☐

28. If yes to question 26, what type of renewable energy do you use?

29. If you do not currently use renewable do you think you farm would benefit from the use of renewable energy?

Yes ☐

No ☐

Protected Agriculture

30. Do you currently use any form of protected agriculture?

Yes ☐

No ☐

31. If yes to question 29, what type of protected agriculture do you practice?

32. If you do not currently practice protected agriculture do you think your farm would benefit from the use of renewable energy?

Yes ☐

No ☐

Basic GAPS for pesticide and fertilizer use on Farm

33. Do you record the use of pesticides and fertilizers on farm?

Yes ☐

No ☐

34. Are your pesticides and fertilizers stored in a separate room from your produce?

Yes ☐

No ☐

35. How do you dispose of pesticide and fertilizer containers?

36. Is your application of fertilizer based on a soil test?

Yes ☐

No ☐

37. Do you apply pesticides based on an economic threshold level?

Yes ☐

No ☐

Organic Agricultural Production Practices

38. Which of the following fertilizers do you utilize?

Organic ☐

Synthetic ☐

Both Types ☐

39. Which of the following Pesticides do you utilize?

Organic ☐

Synthetic ☐

Both Types ☐

40. Please indicate the areas below that you have received training.

☐ Organic Agricultural Practices

☐ Renewable Energy

☐ Water Conservation & Management

☐ Soil Conservation & Management

☐ GAPS in Fertilizer & Pesticide Use

☐ Protected Agriculture

41. What type of farming are you engaged in?

Crop ☐

Livestock ☐

Sugar Cane ☐

42. How many acres of land is under production? _____

43. Please specify your land tenure.

☐ 1=owned with title deed

☐ 2=owned without title deed

☐

3= Rented

☐

4=owned by parents

44. Where exactly is the land located?

45. Is it located in an irrigation district?

Yes ☐

No ☐

46. What is the current market purchase price per acre of the land that you farm?

\$ _____

47. What is the land tax per acre?

\$ _____

48. If renting what is the rent per acre of land?

\$ _____

49. Do you live on the Land?

Yes ☐

No ☐

Personal Information

50. Sex of respondent (Gender)

☐ Male

☐ Female

51. Age of respondent (specify in years).....years (Age)

52. Household size (specify number)

53. Educational level of respondent (EDU)

- ☐ Primary education
- ☐ Secondary education
- ☐ Tertiary education

54. Marital status (MARISTAT)

- ☐ Married
- ☐ Single
- ☐ Divorced/ Separated

Other (specify)_____

55. Occupation of respondent _____

56. Household average income/ month \$ _____

Appendix D: Willingness To Pay Questionnaire

Dear Participant:/Introduction

The Government of Barbados is considering embarking on a programme to improve environmental stewardship and facilitate climate change adaptation within the agricultural sector. This agri-environmental stewardship (AES) programme seeks provide the following national benefits: maintain the traditional agricultural landscape in Barbados, reduce the use of synthetic pesticides and fertilizers, improve soil, and water management, and improve water quality.

Registered farmers participating in the programme will be mandated to utilize environmental stewardship and climate change adaptation practices on all of their agricultural land under production.

The purpose of this questionnaire is to obtain your views on the benefits of such an AES programme, evaluate the potential for a publicly funded Agri-environment stewardship programme and to determine the value that you place on the traditional rural agricultural landscape in Barbados.

The completion of this questionnaire will only require 15 minutes of your time. Please answer the questions within this questionnaire as carefully as possible. Your responses are very important to us and you can be assured that all your personal information will be kept confidential.

If you require any further information or have any comments concerning this study, please free to contact us email at dbynoe@utwente.com/ebabb@agriculture.gov.bb or via telephone at 836-6026.

Background Information

I. Traditional Barbadian Landscape and Current State of Agriculture

Many traditional rural agricultural landscapes can still be found in Barbados in every parish including St. Michael. However, these agricultural landscapes are under threat from competing land use interest. Agricultural land decline from 61,000 acres in 1966 to 31,000 acres in 2016. At the same time agricultural imports have drastically risen. This situation is compounded by the fact that consistently poor agri-environmental stewardship practices have led to a decline in soil organic matter and soil fertility, erosion of premium top soil, a reduction ground water recharge and over reliance on high cost synthetic inputs (pesticides, fertilizers, weedicides that have been linked to various environmental and health problems. The sector also faces the threat of climate change that can make production even more challenging. In order to halt the decline of agricultural land in Barbados, farmers must be incentivized to produce, improve their environmental stewardship, and adapt to climate change for the benefit of society. In the absence of such incentives the tradition agricultural landscape may soon be a relic of the past.

II. Environmental Stewardship & Climate Change Adaptation

Environmental stewardship refers to responsible use and protection of the natural environment through conservation and sustainable practices. Examples of environmental stewardship practices in agriculture include water and soil conservation such as contour ploughing and mulching. Climate change and environmental stewardship are directly linked.

Climate change is the long-term change in average weather conditions, including temperature, precipitation, and wind.

According to the United Nations Intergovernmental Panel on Climate Change (IPPC), which is comprised of the world’s leading scientific experts in the field of climate change, our climate is undergoing dramatic changes as the direct result of greenhouse gas (GHG) emissions from human activity such as carbon dioxide and methane. GHG’s are gases in the atmosphere that act like a glass roof around the earth, trapping in heat that would otherwise escape to space – this is commonly referred to as the “greenhouse effect”.

III. Impact of Poor Environmental Stewardship & Climate Change on the Agricultural Sector on Barbados

C) Flooding B) Cane Fire C) Soil Erosion D) Drought E) Storm Event F) Livestock Heat Stress

Poor environmental stewardship within the agricultural sector can: reduce water quality due overuse of fertilizers and pesticides; reduce the rate of ground water recharge by neglect of field wells; increase soil erosions due to poor soil management; lead to the loss of biodiversity by focusing only on one crop; and negatively impact human health by the unsafe handling and use of pesticides and fertilizer during production.

Changes in mean rainfall and temperate as well as the increase in extreme climate events will affect agriculture, livestock, forestry as well as fisheries. Many climate impacts, such as increased land degradation and soil erosion, changes in water availability, biodiversity loss, more frequent and more intense pest and disease outbreaks as well as disasters can impact on the agricultural sector negatively and need to be addressed to ensure the future viability of the agricultural sector.

IV. Environmental Stewardship and Climate Change Adaptation Benefits to Society

A) Fabric Mulching B) Renewable Energy C) Protected Agriculture D) Water Harvesting E) Increased Farm Profitability F) Improved Water Quality

Appropriate environmental stewardship within the farming community can lead to: improved water quality through the reduction or exclusion of harmful chemicals and pesticides from the production system; reduced soil erosion and improve soil quality due to good soil management; maintenance and enhancement of biodiversity through encouraging polyculture; and improved human health through reduced exposure to harmful pesticides and fertilizers.

Adapting to climate change facilitates the long-term financial feasibility of individual farms since farmers can obtain improved harvests in times of adverse climactic conditions through more climate resilient production system. Appropriate environmental stewardship coupled with adequate adaption to climate change facilitates the long-term economic sustainability of the agricultural sector thus reducing rate of land use change for other purposes. Successful AES programmes have been implemented in the UK, USA, and Europe.

V. Description of Programme Payment

Please consider that the Government of Barbados is exploring the option of embarking on a programme to improve environmental stewardship and facilitate climate change adaptation within the agricultural sector.

Registered farmers who enrol in this AES programme will receive the benefit of an annual environmental and climate stewardship payment. The payment will be made per acre of land enrolled within the programme depending on the level of compliance by the farmer to the AES programme.

Benefits from this programme to the Barbadian society include reduced use of synthetic chemicals, reduced soil erosion, increased rate ground water recharge, improved ground water quality and maintenance of the traditional agricultural/sugar landscape.

Based on the importance that you attach to environmental benefits described above and the maintenance of the traditional Barbadian agri-environmental landscape; if you could be assured that your contribution to the AES programme would only go towards achieving these benefits, would you be willing to pay to support agricultural activities that contribute to the protection of the traditional agricultural landscape, improve environmental stewardship and climate change adaptation as portrayed in the picture below.

Instructions

You will be presented with eight choice cards with three options for Agri-environmental Stewardship that will have an impact on adaptation to climate change and the traditional rural agricultural landscape. Two options (Programme A and Programme B) allows for you to participate in the AES programme based on the perceived benefits of the particular programme and the associated cost. The third option allows you to decide not to participate in the programme. Please see an example of the choice card that you will be presented with below. You can click on each option to get a virtual tour of the impact of each programme relative to the status quo.

9. Which Agri-environmental Stewardship Programme option would you prefer to support? Indicate your selection by placing an X next to your preferred choice.
(May need to make projection to 2025)

	Programme A	Programme B	No Intervention
Use of Synthetic Chemicals	40% reduction	60 % reduction	Status Quo
Soil erosion	60% reduction	20% reduction	Status Quo

Ground Water Recharge/Quality		30% increase	20% increase	Status Quo
Maintenance of Traditional Agricultural Landscape		50%	100%	Status Quo
Increase in annual income Tax/		BDS \$150/ USD \$1.50	BDS \$100/ USD \$1.00	Status Quo
Choice		O	O	O

Each programme will have variations in the cost of the programme due to the degree/quantity of benefits provided or not provided to society and the different cost factors determine the cost of providing these benefits (e.g. cost of implementing alternative farming techniques, paper work required, difference in cost of alternative inputs etc). As a result the payment amount will vary to reflect the composition of the AES programme and associated agri-environmental landscape benefits.

The option A & B has an associated cost per year. The annual payment will be taken out from your income tax deduction and in the case of tourist it would be a payment ascribed to the cost of the room per night.

Please answer question by selecting one of the three options. Please consider your other financial obligations you face on an annual basis when you make your decision.

Choice Cards Version 1:

1. Which Agri-environmental Stewardship Programme option would you prefer to support?
Indicate your selection by placing an X next to your preferred choice.

	Option A	Option B	Status Quo

Use of Synthetic Chemicals	20% reduction	40 % reduction	No change
Soil erosion	20% increase	40 % reduction	No change
Ground Water Recharge/Quality	20% increase	10% increase	No change
Maintenance of Traditional Agricultural Landscape	75%	50%	No change
Increase in annual income Tax	\$50/\$1	\$150/\$2	\$ 0.00
Choice	O	O	O

2. Which Agri-environmental Stewardship Programme option would you prefer to support?
Indicate your selection by placing an X next to your preferred choice.

	Option A	Option B	Status Quo

Use of Synthetic Chemicals	40% reduction	60% reduction	No change
Soil erosion	60% reduction	40% reduction	No change
Ground Water Recharge/Quality	30% reduction	20% increase	No change

Maintenance of Traditional Agricultural Landscape	75%	100%	No change
Increase in annual income Tax	\$100/\$1.50	\$50/\$1.00	\$0.00
Choice	O	O	O

3. Which Agri-environmental Stewardship Programme option would you prefer to support?
Indicate your selection by placing an X next to your preferred choice.

	Option A	Option B	Status Quo

Use of Synthetic Chemicals	40% increase	60% reduction	No change
Soil erosion	60% reduction	40% increase	No change
Ground Water Recharge/Quality	20% increase	25% increase	No change
Maintenance of Traditional Agricultural Landscape	100%	75%	No change
Reduction in annual income Tax	\$150/\$2.00	\$100/\$1.50	\$0.00
Choice	O	O	O

4. Which Agri-environmental Stewardship Programme option would you prefer to support?
Indicate your selection by placing an X next to your preferred choice.

	Option A	Option B	Status Quo

Use of Synthetic Chemicals	60% reduction	20% reduction	No change
Soil erosion	20% reduction	40% reduction	No change
Ground Water Recharge/Quality	20% increase	10% increase	No change
Maintenance of Traditional Agricultural Landscape	75%	100%	No change
Increase in annual income Tax	\$150/\$2.00	\$100/\$1.50	\$0.00
Choice	O	O	O

5. Which Agri-environmental Stewardship Programme option would you prefer to support?
Indicate your selection by placing an X next to your preferred choice.

	Option A	Option B	Status Quo

Use of Synthetic Chemicals	40% reduction	60% decrease	No change
Soil erosion	60% reduction	40% reduction	No change
Ground Water Recharge/Quality	20% increase	30% increase	No change
Maintenance of Traditional Agricultural Landscape	75%	100%	No change
Reduction in annual income Tax	\$50/\$1	\$150/\$2	\$0.00
Choice	O	O	O

6. Which Agri-environmental Stewardship Programme option would you prefer to support?
Indicate your selection by placing an X next to your preferred choice.

	Option A	Option B	Status Quo

Use of Synthetic Chemicals	60% reduction	40% reduction	No change
Soil erosion	60% reduction	40% reduction	No change
Ground Water Recharge/Quality	20% reduction	30% reduction	No change
Maintenance of Traditional Agricultural Landscape	75%	100%	No change
Increase in annual income Tax	\$100/\$1.50	\$50/1	\$0.00
Choice	O	O	O

7. Which Agri-environmental Stewardship Programme option would you prefer to support?
Indicate your selection by placing an X next to your preferred choice.

	Option A	Option B	Status Quo

Use of Synthetic Chemicals	60% reduction	40% reduction	No change
Soil erosion	20% reduction	60% reduction	No change
Ground Water Recharge/Quality	10% increase	30% increase	No change
Maintenance of Traditional Agricultural Landscape	50%	100%	No change

Reduction in annual income Tax	\$50/\$1.00	\$50/\$1.00	\$0.00
Choice	☐	☐	☐

8. Which Agri-environmental Stewardship Programme option would you prefer to support?
Indicate your selection by placing an X next to your preferred choice.

	Option A	Option B	Status Quo

Use of Synthetic Chemicals	40% reduction	60% reduction	No change
Soil erosion	40% reduction	60% reduction	No change
Ground Water Recharge/Quality	30% increase	10% increase	No change
Maintenance of Traditional Agricultural Landscape	75%	100%	No change
Increase in annual income Tax	\$50/\$1.50	\$100/\$1	\$0.00
Choice	☐	☐	☐

Choice Cards Version 2:

9. Which Agri-environmental Stewardship Programme option would you prefer to support?
Indicate your selection by placing an X next to your preferred choice.

	Option A	Option B	Status Quo

Use of Synthetic Chemicals	60% reduction	40 % reduction	No change
Soil erosion	60% increase	40 % reduction	No change
Ground Water Recharge/Quality	30% increase	20% increase	No change
Maintenance of Traditional Agricultural Landscape	100%	75%	No change
Increase in annual income Tax	\$50/\$1	\$100/\$1.50	\$ 0.00
Choice	O	O	O

10. Which Agri-environmental Stewardship Programme option would you prefer to support?
Indicate your selection by placing an X next to your preferred choice.

	Option A	Option B	Status Quo

Use of Synthetic Chemicals	20% reduction	60% reduction	No change
Soil erosion	20% reduction	40% reduction	No change
Ground Water Recharge/Quality	20% reduction	20% increase	No change
Maintenance of Traditional Agricultural Landscape	75%	75%	No change
Increase in annual income Tax	\$150/\$2	\$50/\$1	\$0.00
Choice	O	O	O

11. Which Agri-environmental Stewardship Programme option would you prefer to support?
Indicate your selection by placing an X next to your preferred choice.

	Option A	Option B	Status Quo

Use of Synthetic Chemicals	20% increase	60% reduction	No change
Soil erosion	40% reduction	20% increase	No change
Ground Water Recharge/Quality	20% increase	30% increase	No change
Maintenance of Traditional Agricultural Landscape	50%	75%	No change
Reduction in annual income Tax	\$50/\$1	\$100/\$1.50	\$0.00
Choice	O	O	O

12. Which Agri-environmental Stewardship Programme option would you prefer to support?
Indicate your selection by placing an X next to your preferred choice.

	Option A	Option B	Status Quo

Use of Synthetic Chemicals	20% reduction	40% reduction	No change
Soil erosion	40% reduction	40% reduction	No change
Ground Water Recharge/Quality	30% increase	20% increase	No change
Maintenance of Traditional Agricultural Landscape	75%	100%	No change
Increase in annual income Tax	\$50/\$1.00	\$100/\$1.50	\$0.00
Choice	O	O	O

13. Which Agri-environmental Stewardship Programme option would you prefer to support?
Indicate your selection by placing an X next to your preferred choice.

	Option A	Option B	Status Quo

Use of Synthetic Chemicals	60% reduction	20% decrease	No change
Soil erosion	60% reduction	40% reduction	No change
Ground Water Recharge/Quality	10% increase	20% increase	No change
Maintenance of Traditional Agricultural Landscape	75%	100%	No change

Reduction in annual income Tax	\$50/\$1	\$100/\$1.50	\$0.00
Choice	O	O	O

14. Which Agri-environmental Stewardship Programme option would you prefer to support?
Indicate your selection by placing an X next to your preferred choice.

	Option A	Option B	Status Quo

Use of Synthetic Chemicals	60% reduction	40% reduction	No change
Soil erosion	60% reduction	40% reduction	No change
Ground Water Recharge/Quality	20% reduction	10% reduction	No change
Maintenance of Traditional Agricultural Landscape	50%	75%	No change
Increase in annual income Tax	\$100/\$1.50	\$150/\$2.00	\$0.00
Choice	O	O	O

15. Which Agri-environmental Stewardship Programme option would you prefer to support?
Indicate your selection by placing an X next to your preferred choice.

	Option A	Option B	Status Quo

Use of Synthetic Chemicals	40% reduction	20% reduction	No change

Soil erosion	20% reduction	40% reduction	No change
Ground Water Recharge/Quality	30% increase	20% increase	No change
Maintenance of Traditional Agricultural Landscape	50%	75%	No change
Reduction in annual income Tax	\$150/\$2.00	\$150/\$2.00	\$0.00
Choice	O	O	O

16. Which Agri-environmental Stewardship Programme option would you prefer to support?
Indicate your selection by placing an X next to your preferred choice.

	Option A	Option B	Status Quo

Use of Synthetic Chemicals	40% reduction	60% reduction	No change
Soil erosion	20% reduction	60% reduction	No change
Ground Water Recharge/Quality	10% increase	10% increase	No change
Maintenance of Traditional Agricultural Landscape	100%	50%	No change
Increase in annual income Tax	\$100/\$1.50	\$150/\$2.00	\$0.00
Choice	O	O	O

17. In your opinion, the preceding questions were:

- ☐ Clear
- ☐ Not so Clear
- ☐

Confusing

9. What were the benefits within the programme that you considered as most important? Number your answers with one being the most important.

Maintenance of the Traditional Agricultural/Sugar Landscape ☐

Improved Water Quality ☐

Reduced use of Synthetic Chemicals ☐

Reduced Soil Erosion ☐

Increase Rate of Ground Water Recharge ☐

10. Do you think that the Agri-environmental Stewardship programme if properly designed and implemented will be able to achieve the benefits mentioned above?

Yes ☐ No ☐

57. If you have indicated no to the previous question, please state why and would be a better option to achieve these benefits?

58. What is the principal reason that would cause you to support this programme?

59. If this programme starts next year will you be willing to support it?

Yes ☐ Maybe Yes ☐ Maybe No ☐ No ☐

60. If yes please indicate the maximum annual/per night payment that you are willing make to achieve these National Environmental benefits and maintain the traditional Barbadian Agricultural Landscape \$ _____

61. Would participating in this programme reduce the number of nights stayed in Barbados?

Knowledge Questions

62. When in Barbados how often do you view/drive through a traditional agri-environmental landscape?

- ☐ daily
- ☐ several times per week
- ☐ about once a week
- ☐ several times a month
- ☐ I have not taken viewed/driven through last month

63. Please indicate which of the following activities have you engaged in over the last 12 months?

- ☐ Taken a hike through the countryside
- ☐ Engaged in gardening/farming activities
- ☐ Driven through the St. George Valley
- ☐ Break sugarcane/picked sugarcane
- ☐ Brought sugar cane
- ☐ Took part in any environmental activity
- ☐ Listen to Talk Ya Talk Agriculture
- ☐ watched or listened to an agricultural or environmental related TV or radio programmes
- ☐ none of the above.

64. Are you or have you ever been a member of a farmers group or environmental group?

- ☐ Farmers Group
- ☐ Environmental group
- ☐ None

65. Do you believe that the climate is changing?

Yes No

66. In your opinion what is the most negative consequence of climate change to the agricultural sector?

Drought	☐
Increased Soil erosion	☐
	☐

Flooding

Increase in Invasive Pest/Species ☐

Higher Temperatures ☐

67. In your opinion which of the following farm practices will contribute positively to agri-environmental stewardship and climate change adaptation.

- ☐ Green House Crop Production
- ☐ Wind tunnel Poultry Production
- ☐ Farm utilization of Renewable Energy
- ☐ On Farm Water harvesting, Storage, and distribution
- ☐ Organic Farming
- ☐ Reduction of fertilizer and pesticide use
- ☐ Contour ploughing
- ☐ Utilizing Mulch and drip Irrigation
- ☐ All of the Above

Personal Information

68. Sex of respondent (Gender)

☐ Male

☐ Female

69. Age of respondent (specify in years).....years (Age)

70. What is your country of residence?

71. Please state where do you reside/stay in Barbados?

72. Household size (specify number)

73. Educational level of respondent

- ☐ Primary education
- ☐ Junior high school/middle education
- ☐ Senior high education
- ☐ Teacher training/Nursing training school
- ☐ Vocational/Technical education

Others (specify) _____

74. Marital status

- ☐ Married
- ☐ Single
- ☐ Divorced/ Separated

Other (specify) _____

75. Occupation of respondent _____

76. Household average income/ month \$ _____

Choice Cards Version 2:

18. Which Agri-environmental Stewardship Programme option would you prefer to support?
Indicate your selection by placing an X next to your preferred choice.

	Option A	Option B	Status Quo
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Use of Synthetic Chemicals	60% reduction	40 % reduction	No change
Soil erosion	60% increase	40 % reduction	No change
Ground Water Recharge/Quality	30% increase	20% increase	No change
Maintenance of Traditional Agricultural Landscape	100%	75%	No change
Increase in annual income Tax	\$50	\$100	\$ 0.00
Choice	O	O	O

19. Which Agri-environmental Stewardship Programme option would you prefer to support?
Indicate your selection by placing an X next to your preferred choice.

	Option A	Option B	Status Quo

Use of Synthetic Chemicals	20% reduction	60% reduction	No change
Soil erosion	20% reduction	40% reduction	No change
Ground Water Recharge/Quality	20% increase	20% increase	No change
Maintenance of Traditional Agricultural Landscape	75%	75%	No change

Increase in annual income Tax	\$150	\$50	\$0.00
Choice	☐	☐	☐

20. Which Agri-environmental Stewardship Programme option would you prefer to support?
Indicate your selection by placing an X next to your preferred choice.

	Option A	Option B	Status Quo

Use of Synthetic Chemicals	20% reduction	60% reduction	No change
Soil erosion	40% reduction	20% reduction	No change
Ground Water Recharge/Quality	20% increase	30% increase	No change
Maintenance of Traditional Agricultural Landscape	50%	75%	No change
Reduction in annual income Tax	\$50	\$100	\$0.00
Choice	☐	☐	☐

21. Which Agri-environmental Stewardship Programme option would you prefer to support?
Indicate your selection by placing an X next to your preferred choice.

	Option A	Option B	Status Quo

Use of Synthetic Chemicals	20% reduction	40% reduction	No change
Soil erosion	60% reduction	40% reduction	No change

Ground Water Recharge/Quality	30% increase	20% increase	No change
Maintenance of Traditional Agricultural Landscape	75%	100%	No change
Increase in annual income Tax	\$50	\$100	\$0.00
Choice	O	O	O

22. Which Agri-environmental Stewardship Programme option would you prefer to support?
Indicate your selection by placing an X next to your preferred choice.

	Option A	Option B	Status Quo

Use of Synthetic Chemicals	60% reduction	20% decrease	No change
Soil erosion	60% reduction	40% reduction	No change
Ground Water Recharge/Quality	10% increase	20% increase	No change
Maintenance of Traditional Agricultural Landscape	75%	100%	No change
Reduction in annual income Tax	\$50	\$100	\$0.00
Choice	O	O	O

23. Which Agri-environmental Stewardship Programme option would you prefer to support?
Indicate your selection by placing an X next to your preferred choice.

	Option A	Option B	Status Quo
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Use of Synthetic Chemicals	60% reduction	40% reduction	No change
Soil erosion	60% reduction	40% reduction	No change
Ground Water Recharge/Quality	20% reduction	10% reduction	No change
Maintenance of Traditional Agricultural Landscape	50%	75%	No change
Increase in annual income Tax	\$100	\$150	\$0.00
Choice	O	O	O

24. Which Agri-environmental Stewardship Programme option would you prefer to support?
Indicate your selection by placing an X next to your preferred choice.

	Option A	Option B	Status Quo

Use of Synthetic Chemicals	40% reduction	20% reduction	No change
Soil erosion	20% reduction	40% reduction	No change
Ground Water Recharge/Quality	30% increase	20% increase	No change
Maintenance of Traditional Agricultural Landscape	50%	75%	No change
Reduction in annual income Tax	\$150	\$150	\$0.00

Choice	O	O	O
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25. Which Agri-environmental Stewardship Programme option would you prefer to support?
Indicate your selection by placing an X next to your preferred choice.

	Option A	Option B	Status Quo

Use of Synthetic Chemicals	40% reduction	60% reduction	No change
Soil erosion	20% reduction	60% reduction	No change
Ground Water Recharge/Quality	10% increase	30% increase	No change
Maintenance of Traditional Agricultural Landscape	100%	50%	No change
Increase in annual income Tax	\$100	\$150	\$0.00
Choice	O	O	O

26. In your opinion, the preceding questions were:

☐ Clear

☐ Not so Clear

☐ Confusing

9. What were the benefits within the programme that you considered as most important?
Number your answers with one being the most important.

Maintenance of the Traditional Agricultural/Sugar Landscape ☐

Improved Water Quality ☐

Reduced use of Synthetic Chemicals ☐

Reduced Soil Erosion ☐

Increase Rate of Ground Water Recharge ☐

11. Do you think that the Agri-environmental Stewardship programme if properly designed and implemented will be able to achieve the benefits mentioned above?

Yes ☐ No ☐

77. If you have indicated no to the previous question, please state why and would be a better option to achieve these benefits?

78. What is the principal reason that would cause you to support this programme?

79. If this programme starts next year will you be willing to support it?

Yes ☐ Maybe Yes ☐ Maybe No ☐ No ☐

80. If yes please indicate the maximum annual/per night payment that you are willing make to achieve these National Environmental benefits and maintain the traditional Barbadian Agricultural Landscape \$ _____

81. Would participating in this programme reduce the number of nights stayed in Barbados?

Knowledge Questions

82. When in Barbados how often do you view/drive through a traditional agri-environmental landscape? coded

- ☐ Daily 4
- ☐ several times per week 3
- ☐ about once a week 2
- ☐ several times a month 1
- ☐ I have not taken viewed/driven through last month 0

83. Please indicate which of the following activities have you engaged in over the last 12 months? Score 1 point per activity.

- ☐ Taken a hike through the countryside
- ☐ Engaged in gardening/farming activities
- ☐ Driven through the St. George Valley
- ☐ Break sugarcane/picked sugarcane
- ☐ Brought sugar cane
- ☐ Took part in any environmental activity
- ☐ Listen to Talk Ya Talk Agriculture
- ☐ watched or listened to an agricultural or environmental related TV or radio programmes
- ☐ none of the above. 0 point

84. Are you or have you ever been a member of a farmers group or environmental group?
1 = farmers or environmental group 0 = None

- ☐ Farmers Group
- ☐ Environmental group
- ☐ None 0

85. Do you believe that the climate is changing?

Yes No 1 /0

86. In your opinion what is the most negative consequence of climate change to the agricultural sector? E.g. MN Drought 1/0 same for others. Placed in categories

Drought	☐
Increased Soil erosion 2	☐
Flooding	☐
Increase in Invasive Pest/Species	☐
Higher Temperatures	☐

87. In your opinion which of the following farm practices will contribute positively to agri-environmental stewardship and climate change adaptation.

- ☐ Green House Crop Production
- ☐ Wind tunnel Poultry Production
- ☐ Farm utilization of Renewable Energy

- ☐ On Farm Water harvesting, Storage, and distribution
- ☐ Organic Farming
- ☐ Reduction of fertilizer and pesticide use
- ☐ Contour ploughing
- ☐ Utilizing Mulch and drip Irrigation
- ☐ All of the Above

Personal Information

88. Sex of respondent (Gender)

- ☐ Male
- ☐ Female

89. Age of respondent (specify in years).....years (Age)

90. What is your country of residence?

91. Please state where do you reside/stay in Barbados?

92. Household size (specify number)

93. Educational level of respondent

- ☐ Primary education
- ☐ Junior high school/middle education
- ☐ Senior high education
- ☐ Teacher training/Nursing training school
- ☐ Vocational/Technical education

Others (specify) _____

94. Marital status

☐ Married

☐ Single

☐ Divorced/ Separated

Other (specify) _____

95. Occupation of respondent _____

96. Household average income/ month \$ _____

Appendix E: 3D Rendering Methodology

2D View

ASC Files

1. The ASC files were unzipped.

The result was 165 ASC files.

2. These ASC files were mosaicked into a single file in an ERDAS IMAGINE format, i.e. *.img.

The mosaic was performed using ESRI's ArcGIS software. The settings used were:

The resultant mosaic was in IMG format and approximately 211 MB in size.

3. To view the asc_mosaic.img image in ERDAS IMAGINE, go to **Start menu > Programs > ERDAS IMAGINE 2016** and choose **ERDAS IMAGINE 2016**.
4. Go to **File > Open > Raster Layer...** and navigate to the folder containing the asc_mosaic.img file.

Choose the asc_mosaic.img file under the **File** tab.
Under the Raster Options tab, check **Fit to Frame**.
Click **OK**.
5. To view the image metadata, on the **Home** tab, in the **Information** section, choose **Metadata**.

The image metadata of the mosaicked ASCII file is shown below:

The coordinate system (projection and elevation information) was applied to the mosaic ASC file.

Projection Info:	Projection: Transverse Mercator Spheroid: Clarke 1880 RGS Datum: Barbados 1938 EPSG Code: 21292
------------------	--

The screenshot shows a window titled "Elevation Info Chooser". Inside the window, there are four dropdown menus arranged in two rows. The first row contains "Spheroid Name" and "Datum Name". The second row contains "Elevation Units" and "Elevation Type". The selected values are "Clarke 1880 RGS", "Barbados 1938", "meters", and "height" respectively.

The full parameters are outlined below:

a. Projection:

- i. Projection Type: Transverse Mercator
- ii. Spheroid Name: Clarke 1880 RGS
- iii. Spheroid Axis: 6378249.145000, 6356514.869550
- iv. Datum Name: Barbados 1938
- v. Datum Parameters: 31.95, 300.99, 419.19, 0.00, 0.00, 0.00, 0.00
- vi. Scale Factor: 0.999999
- vii. Longitude of Central Meridian: 59° 33' 35" W
- viii. Latitude of Origin: 13° 10' 35" N
- ix. False Easting: 30000 m
- x. False Northing: 75000 m
- xi. EPSG Code: 21292

b. Elevation:

- i. Spheroid Name: Clarke 1880 RGS
- ii. Datum Name: Barbados 1938
- iii. Elevation Units: metres
- iv. Elevation Type: height

ORTHO Files

1. The ORTHO files were unzipped.

The result was 165 ortho images in ECW format.

2. These ECW files were loaded into ERDAS IMAGINE's MosaicPro and a mosaic was performed to produce a single file of the ORTHO images.

The resultant mosaic was in ECW format and approximately 360 MB in size.

3. The image metadata of the mosaicked ECW file is shown below:

The coordinate system projection of the mosaic ECW file was edited as shown below:

This is the same coordinate system applied to the DSM.

3D View

ImageDrape

1. With the DSM and orthomosaic loaded into ERDAS IMAGINE, right-click within 2D View #1 and choose **Start Image Drape with Contents**.

A new window opens with the image drape.

2. You can save this project by going to **File > Save > Project...**

The saved project will be a **VirtualGIS Project (*.vwp)**.

3. You can apply the following options using **Utility > Options...**

- a. DSM

- i. **Exaggeration**

The exaggeration allows you to enhance subtle elevation changes in the DEM.

- ii. **Viewing Range**

The viewing range allows you to change the distance that the observer can see across the image.

4. You can change the level of detail (LOD) to the DSM and orthomosaic using **View > LOD Control...**

The Level of Detail allows you to increase or decrease the image resolution for the DSM and the orthomosaic.

Note that the lower the LOD, the lower the resolution and the faster the display.

5. You can change the position parameters of the viewer using **Position > Current Position...**

Here, you can change the **X** and **Y** coordinates of the viewer, the height above ground (**AGL**), the height above sea level (**ASL**) and the direction: **Field of View (FOV)**, **Pitch**, **Azimuth** (look angle) and **Roll**.

Virtual GIS

1. With the DSM and orthomosaic loaded into ERDAS IMAGINE, right-click within 2D View #1 and choose Start Image Drape with Contents.

A new window opens with the data called a 3D View #1.

2. You can save this project by going to **File > Save As > Project As...**

The saved project will be a VirtualGIS Project (*.vwp).

3. Click on the **Scene** tab to make edits based on the following:

- a. Scene

- i. Properties

1. DEM: Exaggeration, Viewing Range, Render Top Side Only

The Render top side only is recommended over the entire DEM being rendered as the top side is all that is needed for your needs and will save on memory usage.

2. Motion: Motion Speed = 1, Terrain Offset = 2, Percent Distance = 75

- ii. Level of Detail

1. DEM LOD %: 75
2. Raster LOD %: 100

The Level of Details shown above consumed approximately 1GB memory. So if you want to mimic this, then you need to be sure that you have the capacity.

- b. Navigation

- i. Position Editor (position of the viewer)

1. X = 32750 m
2. Y = 70400 m
3. AGL = 647 m
4. ASL = 820 m
5. FOV = 50
6. Pitch = -24
7. Azimuth = 180

- ii. Flight Path Editor

A flight path was saved. You can create additional flight paths by following the steps in the link below.

<https://hexagongeospatial.fluidtopics.net/book#!book;uri=1d2b29b31b09e59a778ba5980ab5f5d7;breadcrumb=8039fa552bbb7f82ce86eddebcccc7f2-972b8fdeeb2a1be598bda0ddee9fc96d-335ddc44a6c088ffe7aca4b83503ff67-4bd6eb37a4dcc642ba055f2e3926c51a>

- c. Recording

- i. Start

Clicking **Start** opens the **Select Output Movie File** dialog box. Choose *.avi format as I have experienced problems with the *.mpeg format. You may need to download DIVX or VLC video software in order to view the *.avi file.

- ii. Stop

This stops the video recording.

SUMMARY

Small Island Developing States (SIDS) are a subset of small states that are disproportionately impacted by climate change due to their inherent fragility including small but growing populations, limited resources, remoteness, susceptibility to natural disasters, vulnerability to external shocks, excessive dependence on international trade, and fragile environment. These unique challenges which are internationally recognized by the UN threaten sustainable development and impact the ability of SIDS to appropriately implement climate change adaptation and environmental stewardship policy. Climate change adaptation and Agri-environmental stewardship have multi-level implications and therefore is best addressed using a multi-level approach. There is a huge gap in the literature within SIDS with reference to MLG and its relationship with both climate change adaptation and agri-environmental stewardship policy development and implementation. This thesis seeks to determine the impact of MLG on climate change adaptation and environmental stewardship policy in SIDS.

The information derived from this research is aimed at facilitating improved climate change adaptation and environmental stewardship policy formulation and implementation, within the agricultural sector of SIDS with multi-level governance structures; by understanding, explaining and simulating how macro-level climate change adaptation and environmental stewardship policy results emerge from the micro level behaviour of actors. This is achieved through: the identification of the MLG present and its impact on the policy formulation and implementation process (Chapter 2); the utilization of Contextual Interaction Theory (CIT) to explain how the adequacy of implementation of climate change adaptation and environmental stewardship policy can be improved (Chapter 3); the determination of the specific agri-environmental stewardship policy attributes and associated willingness-to-accept (WTA) that drive farm environmental stewardship and climate change adaptation behaviour (Chapter 4); and the degree to which farmers' WTA driven by the AES policy can be supported by Taxpayers' WTP and how does this relate to MLG (Chapter 5).

The MLG system is extensively examined in European studies but attention on this matter within SIDS has been limited. In this research the presence and impact of MLG on climate change adaptation and agri-environmental policy within SIDS utilizing the case of Barbados is studied (Chapter 2). For the purpose of this study a systematic description of the relevant governance structures and climate policies at multiple levels was completed, the type of MLG present and its impact on climate change adaptation and environmental stewardship policy formulation and implementation with reference to the agricultural sector was identified. The results reveal that the predominant form of multi-level governance adopted was type 1. They also revealed a deepening of MLG above the state level and an under development of local government. This has led to an imbalance in the MLG structure and the associated climate change adaptation policy within the agricultural sector which has not properly taken into consideration the specific enabling conditions required at the local and community level.

Climate change adaptation and environmental stewardship policy implementation occurs at multiple levels within the MLG structure. This research explores whether improved adequacy of climate change policy implementation can be facilitated in the presence of MLG if the main actors,

especially at the local level, possess or are empowered with the appropriate balance of motivation, cognition and power and are held accountable for their actions (Chapter 3). This was facilitated through the lens of CIT as a framework for the evaluation of climate change adaptation policy implementation. Firstly, the main elements of CIT are outlined and later through the translation of the theory into an empirical model, it is then utilized to address the question at hand. A case study approach is applied to climate change adaptation projects in Caribbean, African and Pacific SIDS implemented by the Global Environment Facility Small Grants Programme. Case selection criteria are developed, and 19 cases drawn from the three geographical areas selected. The questionnaire applied by Owens (1998) in the first attempt to create an empirical model for CIT has been slightly modified, adjusting for the shortcomings identified in the first empirical study and widening its application to model climate change adaptation implementation.

The results demonstrate that community-based climate change adaptation policy implementation adequacy is driven by the most positive actor. If the most positive actor is the implementer, one must be cautious on overly zealous motivation on the part of the implementer as this may contribute to forced cooperation thus impacting the adequacy of implementation negatively. To maximize the adequacy of implementation it is important that the process is ultimately owned and driven from the bottom up by highly motivated target actors. Furthermore, an imbalance in cognition between the target and implementer impacts negatively on adequacy of implementation. This gap can be filled, and balance restored if both actors are positively motivated and active learning ensues. This study shows the importance of placing special emphasis on measuring and reducing the accountability gap between actors to improve adequacy of policy implementation. An imbalance in power between actors impacts implementation adequacy negatively if the implementer holds the balance of power.

Climate change presents the need to improve agri-environmental stewardship and move towards a resource-efficient green economy. Ensuring agricultural programs and policies facilitate adequate adaptation to climate change has taken on increased importance in the wake of increasing frequency of extreme climate events. For this, the research explores the premise that well designed geographically specific payment strategies within the context of an Agri-environmental Scheme (AES) will improve climate adaptation and agri-environmental stewardship among farmers (Chapter 4). A choice experiment (CE), spatial analysis and socioeconomic data are used to reveal farmers' preferences for Agri-environmental Scheme attributes that encourage climate change adaptation and environmental stewardship within the Small Island Developing State of Barbados. These reveal preferences subsequently undergo simulation under multiple policy scenarios to inform adoption rates and the associated policy recommendations.

The participation and is determined by the location of the production zone. The production zone location influences the probability of participation and therefore it is possible to offer specific differentiated geographical payments to increase the probability of participation within the two different production zones identified within this study. With regards to socioeconomic factors the most relevant were income and previous environmental behaviour. The results also show that protected agriculture and sound soil & water management are the policy attributes that drive farm environmental stewardship and climate change adaptation.

AES policy funded by taxpayers are argued to support traditional agricultural landscapes and climate resilience. Yet, empirical evidence of actual policy applications varies per context, offering mixed results. Therefore, this research also focuses on contextualizing the role and impact of AES policy attributes on the WTP and its voluntary support by taxpayers (Chapter 5). A virtual choice experiment, spatial analysis and socioeconomic data are used to reveal taxpayers' preferences for specific climate adaptation and environmental stewardship benefits of AES. These revealed preferences of taxpayers are used to estimate WTP, the level voluntary support and the feasibility of the scheme policy based on the AES services reflected in the policy. The results demonstrate that the inclusion of the maintenance of agricultural land and synthetic chemical reduction within the AES policy would maximize WTP and voluntary participation by taxpayers.

This research demonstrates that the presence of MLG as in the SIDS's case under examination has led to a weakening of governance below the state and a voluntary dispersal of power and authority above the state particularly as it relates to climate change adaptation and environmental stewardship policy. It demonstrates that this imbalance has led to the development of policies dominated by supranational perspectives and lacking appropriate local contextualization. Thus, it has led to conceiving climate change adaptation and environmental stewardship policies with spatial misfits that lack contextualization and the resources to adequately implement them. As a result, Governments within SIDS continue to look above the state for the resources to implement these policies, but this can lead to increased maladaptation as the resources often come with predefined notions of adaptation and stewardship. Moreover, it demonstrates that it is possible to achieve local contextualization of the CCA and ES policies while ensuring that the resource GAP can be filled by local taxpayers if they are willing to pay as much or more than the cost of adaptation.

The contextual nature of policy makes it clear that each SIDS that intends to develop and implement climate change adaptation and environmental stewardship within the agricultural sector should undertake an appropriate behavioural analysis. Such an analysis will ensure that: the policy attributes included within the policy developed maximize motivation and voluntary participation from key actors, the cognition gaps are addressed, accountability mechanisms are in place and the appropriate resources are available to support climate change adaptation and behavioural changes towards greater environmental stewardship.

SAMENVATTING

Kleine eilandstaten in ontwikkeling (small island developing states – SIDS) zijn een subgroep van kleine staten die onevenredig zwaar worden getroffen door de klimaatverandering vanwege hun inherente kwetsbaarheid, waaronder kleine maar groeiende bevolkingen, beperkte hulpbronnen, afgelegen ligging, gevoeligheid voor natuurrampen, kwetsbaarheid voor externe schokken, buitensporige afhankelijkheid van de internationale handel en een kwetsbaar milieu. Deze unieke uitdagingen, die internationaal worden erkend door de VN, bedreigen de duurzame ontwikkeling en hebben gevolgen voor het vermogen van kleine insulaire ontwikkelingslanden om het beleid inzake de aanpassing aan de klimaatverandering en het beheer van het milieu op passende wijze uit te voeren. De aanpassing aan de klimaatverandering en het beheer van het milieu in de landbouw hebben gevolgen op meerdere niveaus en kunnen daarom het best worden aangepakt met een aanpak op meerdere niveaus. In dit proefschrift wordt getracht het effect van multilevel governance (MLG) op het beleid inzake aanpassing aan de klimaatverandering en milieuentmeesterschap in kleine eilandstaten in ontwikkeling te bepalen.

De informatie die uit dit onderzoek wordt verkregen, is gericht op het vergemakkelijken van een betere formulering en uitvoering van het beleid inzake aanpassing aan de klimaatverandering en milieuentmeesterschap binnen de landbouwsector van kleine insulaire ontwikkelingslanden met bestuursstructuren op meerdere niveaus; door te begrijpen, uit te leggen en te simuleren hoe de resultaten van het beleid inzake aanpassing aan de klimaatverandering op macroniveau en milieuentmeesterschap voortkomen uit het gedrag van de actoren op microniveau. Dit wordt bereikt door: de identificatie van de aanwezige MLG en het effect ervan op het beleidsformulerings- en uitvoeringsproces (hoofdstuk 2); het gebruik van Contextual Interaction Theory (CIT) om uit te leggen hoe de adequaatheid van de uitvoering van het beleid inzake aanpassing aan de klimaatverandering en milieuzorg kan worden verbeterd (hoofdstuk 3); de vaststelling van de specifieke beleidskenmerken voor milieuzorg in de landbouw en de daarmee samenhangende bereidheid tot acceptatie (willingness-to-accept - WTA) die het gedrag van landbouwbedrijven op het gebied van milieuzorg en aanpassing aan de klimaatverandering stimuleren (hoofdstuk 4); en de mate waarin de door het AES-beleid gestuurde WTA van landbouwers kan worden ondersteund door het WTP (willingness-to-pay) van de belastingbetalers en hoe dit zich verhoudt tot MLG (hoofdstuk 5).

Het MLG-systeem wordt uitgebreid onderzocht in Europese studies, maar de aandacht voor deze kwestie binnen SIDS is beperkt. In dit onderzoek wordt de aanwezigheid en de impact van MLG op de aanpassing aan de klimaatverandering en het agromilieubeleid binnen SIDS bestudeerd aan de hand van het geval van Barbados (hoofdstuk 2). Voor dit onderzoek werd een systematische beschrijving van de relevante bestuursstructuren en het klimaatbeleid op meerdere niveaus afgerond, werd het type MLG dat aanwezig is vastgesteld en werd de impact ervan op de aanpassing aan de klimaatverandering en de formulering en uitvoering van het beleid inzake milieuzorg met betrekking tot de landbouwsector geïdentificeerd. Uit de resultaten blijkt dat de voornaamste vorm van multilevel governance type 1 was. Ook is gebleken dat de MLG vooral boven het staatsniveau is gevormd en dat het lokale bestuur nog in ontwikkeling is. Dit heeft geleid tot een onbalans in de MLG-structuur en het daarmee samenhangende beleid voor aanpassing aan de klimaatverandering binnen de landbouwsector, waarbij onvoldoende rekening is gehouden met

de specifieke voorwaarden die op lokaal en gemeenschapsniveau nodig zijn om dit mogelijk te maken.

De aanpassing aan de klimaatverandering en de uitvoering van het milieubeleid vinden plaats op meerdere niveaus binnen de MLG-structuur. In dit onderzoek wordt onderzocht of een betere uitvoering van het klimaatveranderingsbeleid in aanwezigheid van MLG kan worden vergemakkelijkt als de belangrijkste actoren, met name op lokaal niveau, over het juiste evenwicht van motivatie, cognitie en macht beschikken en verantwoordelijk worden gesteld voor hun acties (hoofdstuk 3). Dit werd vergemakkelijkt door het gebruik van de lens van CIT als kader voor de evaluatie van de uitvoering van het beleid inzake de aanpassing aan de klimaatverandering. Eerst worden de belangrijkste elementen van CIT geschetst en later, door de vertaling van de theorie in een empirisch model, wordt het gebruikt om de vraag in kwestie aan te pakken. Een casestudy-aanpak wordt toegepast op projecten voor aanpassing aan de klimaatverandering in SIDS in het Caribisch gebied, Afrika en de Stille Oceaan en die worden uitgevoerd door het Global Environment Facility Small Grants Programme. Er worden case-selectiecriteria ontwikkeld en er worden 19 casussen uit de drie geselecteerde geografische gebieden getrokken. De vragenlijst die door Owens (1998) werd toegepast bij de eerste poging om een empirisch model voor CIT te creëren, is licht gewijzigd, waarbij de tekortkomingen die in de eerste empirische studie werden vastgesteld, zijn gecorrigeerd en de toepassing ervan is uitgebreid tot de uitvoering van het model voor de aanpassing aan de klimaatverandering.

De resultaten tonen aan dat de meest positieve actor het beleid voor de aanpassing aan de klimaatverandering op communautair niveau uitvoert. Als de meest positieve actor de uitvoerder is, moet men voorzichtig zijn met al te ijverige motivatie van de uitvoerder, aangezien dit kan bijdragen tot gedwongen samenwerking, wat een negatieve invloed kan hebben op de adequaatheid van de uitvoering. Om de adequaatheid van de implementatie te maximaliseren is het belangrijk dat het proces uiteindelijk in handen is van zeer gemotiveerde doelactoren en door hen van onderaf wordt aangestuurd. Bovendien heeft een onbalans in kennis tussen de doelgroep en de uitvoerder een negatief effect op de adequaatheid van de implementatie. Deze leemte kan worden opgevuld en het evenwicht kan worden hersteld als beide actoren positief gemotiveerd zijn en er actief wordt geleerd. Deze studie toont aan hoe belangrijk het is om speciale nadruk te leggen op het meten en verminderen van de verantwoordingskloof tussen actoren om de adequaatheid van de beleidsuitvoering te verbeteren. Een onevenwichtige machtsverhouding tussen actoren heeft een negatief effect op de adequaatheid van de uitvoering als de uitvoerder te zeer het machtsoverwicht heeft.

De klimaatverandering toont aan dat het beheer van het landbouwmilieu moet worden verbeterd en dat er een groene economie moet komen die efficiënt gebruik maakt van de hulpbronnen. Het waarborgen van landbouwprogramma's en -beleidsmaatregelen ter vergemakkelijking van een adequate aanpassing aan de klimaatverandering is van toenemend belang geworden in de nasleep van de toenemende frequentie van extreme klimaatgebeurtenissen. Daarom wordt in het onderzoek uitgegaan van de veronderstelling dat goed opgezette, geografisch specifieke betalingsstrategieën in het kader van een agro-milieuregeling (AES) de aanpassing aan de klimaatverandering en het beheer van het landbouwmilieu bij de landbouwers zullen verbeteren (hoofdstuk 4). Een keuze-experiment (CE), ruimtelijke analyse en sociaaleconomische gegevens worden gebruikt om de voorkeuren van de landbouwers voor agro-milieuregelingen aan het licht te brengen die de

aanpassing aan de klimaatverandering en het rentmeesterschap in de kleine eilandstaat Barbados bevorderen. Deze preferenties worden vervolgens gesimuleerd in verschillende beleidsscenario's om de adoptiegraad en de bijbehorende beleidsaanbevelingen te bepalen.

De deelname en wordt bepaald door de ligging van de productiezone. De ligging van het productiegebied beïnvloedt de waarschijnlijkheid van deelname en daarom is het mogelijk om specifieke gedifferentieerde geografische betalingen aan te bieden om de waarschijnlijkheid van deelname binnen de twee verschillende productiegebieden die in deze studie zijn geïdentificeerd, te vergroten. Wat de sociaaleconomische factoren betreft, zijn het inkomen en het vroegere milieugedrag het meest relevant. De resultaten laten ook zien dat beschermde landbouw en goed bodem- en waterbeheer de beleidskenmerken zijn die het milieubeheer en de aanpassing aan de klimaatverandering in de landbouw stimuleren.

Door de belastingbetaler gefinancierde agromilieubeleidsregelingen zijn bedoeld om het traditionele agrarische landschap en de klimaatbestendigheid te ondersteunen. Toch verschilt het empirisch bewijs van de feitelijke beleidstoepassingen per context, wat gemengde resultaten oplevert. Daarom richt dit onderzoek zich ook op het contextualiseren van de rol en de impact van agro-milieu beleidsattributen (AES) op de willingness-to-pay (WTP) en de vrijwillige steun van de belastingbetaler (hoofdstuk 5). Een virtueel keuze-experiment, ruimtelijke analyse en sociaaleconomische gegevens worden gebruikt om de voorkeuren van de belastingbetaler voor specifieke klimaataanpassing en de voordelen van AES voor het milieubeheer aan het licht te brengen. Deze voorkeuren van belastingbetalers worden gebruikt om een schatting te maken van het WTP, het niveau van de vrijwillige steun en de haalbaarheid van het beleid van de regeling op basis van de AES-diensten die in het beleid worden weerspiegeld. De resultaten tonen aan dat de opname van het behoud van landbouwgrond en de vermindering van synthetische chemische stoffen in het AES-beleid de willingness-to-pay (WTP) en de vrijwillige deelname van de belastingbetalers zou maximaliseren.

Dit onderzoek toont aan dat de aanwezigheid van MLG zoals in het onderzochte geval van de SIDS heeft geleid tot een verzwakking van het bestuur onder het staatsniveau en een vrijwillige verspreiding van de macht en het gezag naar organisaties boven het niveau van de staat, met name in verband met de aanpassing aan de klimaatverandering en het beleid inzake milieuzorg. Het toont aan dat deze onevenwichtigheid heeft geleid tot de ontwikkeling van beleid dat wordt gedomineerd door supranationale perspectieven en een gebrek aan passende lokale contextualisering. Het heeft dus geleid tot een beleid van aanpassing aan de klimaatverandering en milieubewustzijn met een gebrek aan contextualisering en de middelen om dit beleid adequaat uit te voeren. Als gevolg daarvan blijven regeringen binnen SIDS naar organisaties boven de eigen staat kijken voor de middelen om dit beleid uit te voeren. Dit kan echter leiden tot een verhoogde maladaptatie, omdat de middelen vaak met vooraf gedefinieerde begrippen van aanpassing en rentmeesterschap komen. Bovendien toont het onderzoek aan dat het mogelijk is om een lokale contextualisering van het CCA- en ES-beleid te bereiken en er tegelijkertijd voor te zorgen dat de middelen van de GAP door de lokale belastingbetalers kunnen worden opgevuld als zij bereid zijn om zoveel of meer te betalen als de kosten van de aanpassing.

De contextuele aard van het beleid maakt duidelijk dat elke klein insulair ontwikkelingsland dat voornemens is om de aanpassing aan de klimaatverandering en het milieubeheer binnen de

landbouwsector te ontwikkelen en uit te voeren, een passende gedragsanalyse moet uitvoeren. Een dergelijke analyse zal ervoor zorgen dat: de beleidskenmerken die in het ontwikkelde beleid zijn opgenomen, de motivatie en de vrijwillige deelname van de belangrijkste actoren maximaliseren, dat de leemten in de kennis worden opgevuld, er een verantwoordingsmechanisme wordt ingesteld en dat de nodige middelen beschikbaar komen om de aanpassing aan de klimaatverandering en de gedragswijzigingen ten aanzien van milieurentmeesterschap te ondersteunen.

AUTHOR BIOGRAPHY

David Bynoe is an agronomist, economist, and international sustainable development specialist. He has strong passion for God, empowering people and protecting the environment. David currently works as the National Coordinator of the Global Environmental Facility-Small Grants Programme (GEF-SGP) at the United Nations Development Programme (UNDP) Multi-Country Office for Barbados & the OECS. As National Coordinator he is mainly responsible for effective management of the GEF-SGP local team, the SGP programme and its portfolio of projects. Previously, David worked for seven years as an Agronomist with the Ministry of Agriculture, Food, Fisheries & Water Resource Management (MAFFW) and was awarded for his significant impact on the agricultural sector. In that capacity he developed and managed the National Organic Research and Development Programme and provided environmental economic advice to various government agencies and international organizations. David is a trained Environmental Economist with a Masters in Environmental Economics and Environmental Management (Distinction) from the University of York, United Kingdom (UK). He pursued this masters as a Commonwealth Scholar to the UK after completing a first degree in Agricultural Science from the University of the West Indies in Trinidad & Tobago. In addition, he has received specialized training in The Economics of Ecosystems & Biodiversity (TEEB) facilitated by the United Nations Environmental Programme.

Utilizing these multidisciplinary skills, David served on the Barbados Green Economy National Steering Committee providing agricultural and environmental economic guidance. He currently sits on the National Climate Change Committee and is a technical advisor on Blue Economy development. In addition, he served as a member of the United Nations Environmental Programme Scientific and Expert Review Team that assesses emerging issues impacting Small Island Developing States. David concluded his Ph.D. research work with the University of Twente focusing on Multi-level Governance, Climate Change Adaptation and Agri-Environmental Stewardship within Small States. David has founded, led, and served on the Board of many national and international charitable organizations. His life mission is to serve God, through serving others and protecting the environment. He currently resides in the island of Barbados with his wife, Eldawna and their daughter Faith.

This body of work contributes towards the understanding and explanation of how macro-level climate change adaptation and agri-environmental stewardship policy results emerge in Small Island Developing States (SIDS) from the micro-level behaviour of actors within the context of Multi-level Governance (MLG). There is a huge gap in the literature within SIDS with reference to MLG and its relationship with climate change adaptation and agri-environmental stewardship policy development and implementation. To contribute to addressing this gap a mixed methods approach is applied, utilizing both a multi-case and single case study. This approach draws from cases in African, Caribbean and Pacific SIDS with particular emphasis on Barbados for more in-depth case analysis and modelling. Contextual Interaction Theory (CIT), Choice Experiments and the MLG Framework are the main tools being utilized to determine and simulate the drivers of behavioral change. This is achieved through: the identification of how MLG presents itself, its impact on the policy formulation and implementation process; the utilization of CIT to explain how the adequacy of implementation of climate change adaptation and environmental stewardship policy can be improved; the determination of the specific agri-environmental stewardship policy attributes and associated willingness-to-accept (WTA) that drive farm environmental stewardship and climate change adaptation behaviour; and the degree to which farmers' WTA driven by the AES policy can be supported by Taxpayers' WTP and how does this relate to MLG. The qualitative and quantitative results from the different components of this study are used to determine the impact of MLG on climate change adaptation and agri-environmental stewardship policy within SIDS. The findings emphasize the contextual nature of policy within a MLG framework and makes it clear that each SIDS that intends to develop and implement adaptation and environmental stewardship policy within the agricultural sector should undertake an appropriate behavioral analysis. Such an analysis will ensure that: the policy attributes included within the policy developed maximize motivation and voluntary participation from key actors, cognition gaps are addressed, accountability mechanisms are in place and the appropriate resources are available to support climate change adaptation and behavioural changes towards environmental stewardship within the specific geographic space.