AN INTEGRATED NATIONAL DISASTER RISK REDUCTION AND CLIMATE CHANGE ADAPTATION (DRR-CCA) DEVELOPMENT INVESTMENT FRAMEWORK FOR BARBADOS- A SMALL ISLAND DEVELOPING STATE (SIDS)

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SCHOOL OF ENVIRONMENT, EDUCATION AND DEVELOPMENT
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<tr>
<td>AIMS</td>
<td>Africa, Indian Ocean, Mediterranean and South China Sea</td>
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<td>AOSIS</td>
<td>Alliance of Small Island States</td>
</tr>
<tr>
<td>CARICOM</td>
<td>Caribbean Community</td>
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<tr>
<td>CARICOF</td>
<td>Caribbean Climate Outlook Forum</td>
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<tr>
<td>CCA</td>
<td>Climate Change Adaptation</td>
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<td>Caribbean Community Climate Change Centre</td>
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<td>CCRIF</td>
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<td>CDEMA</td>
<td>Caribbean Disaster Emergency Management Agency</td>
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<td>CIMH</td>
<td>Caribbean Institute for Meteorology and Hydrology</td>
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<tr>
<td>CRAM</td>
<td>Common Risk Assessment Methodology</td>
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<td>CRMP</td>
<td>Coastal Risk Assessment and Management Programme</td>
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<tr>
<td>DEM</td>
<td>Department of Emergency Management</td>
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<tr>
<td>DEO</td>
<td>District Emergency Organisation</td>
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<td>DRR</td>
<td>Disaster Risk Reduction</td>
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<td>DRR-CCA</td>
<td>Integrating DRR and CCA</td>
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<td>EC</td>
<td>Eastern Caribbean</td>
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<td>EIA</td>
<td>Environmental Impact Assessment</td>
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<td>ES</td>
<td>Exposure and or physical susceptibility</td>
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<td>EM-DAT</td>
<td>Emergency Events Database</td>
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<td>GDP</td>
<td>Gross Domestic Product</td>
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<td>Greenhouse Gas</td>
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<td>Government of Barbados</td>
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<td>Inter-American Development Bank</td>
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<td>IDNDR</td>
<td>International Decade for Natural Disaster Reduction</td>
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<td>IRGC</td>
<td>International Risk Governance Council</td>
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<tr>
<td>LR</td>
<td>Lack of resilience</td>
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<td>MOVE</td>
<td>Methods for the Improvement of Vulnerability</td>
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<tr>
<td>Assessment in Europe</td>
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<tr>
<td>MP</td>
<td>Member of Parliament</td>
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<td>NAP</td>
<td>National Adaptation Plan</td>
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<td>NCRIP</td>
<td>National Coastal Risk Information and Planning Platform Programme</td>
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<td>OHRLLS</td>
<td>UN Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States</td>
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<td>Planning Support Systems</td>
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<td>UNISDR</td>
<td>United Nations Office for Disaster Risk Reduction</td>
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<td>VA</td>
<td>Vulnerability Assessment</td>
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Abstract of Thesis submitted by Nicole Michelle Greenidge for the degree of Doctor of Philosophy and entitled:

**An Integrated National Disaster Risk Reduction and Climate Change Adaptation Development Investment Framework for Barbados- A Small Island Developing State (SIDS)**

*September, 2017*

Disasters and climate change threaten the very existence of a special group of developing states- Small Island Developing States (SIDS). This research tackles the problem of limited uptake of integrated approaches to address risk in practice- in particular through disaster risk reduction (DRR) and climate change adaptation (CCA). The benefits of these approaches are so significant that they can be considered to be investments in development. Focusing on Barbados, a SIDS, this research therefore seeks to identify the prospects for establishing an integrated disaster risk reduction and climate change adaptation (DRR-CCA) development decision-making framework. It also seeks to understand the policy implications for other SIDS.

In addressing the research problem, a risk governance framework and mixed methods approach is proposed for identifying the prospects for DRR-CCA. This allows for the challenges and the potential in actor networks, institutions, and the various dimensions of risk decision-making to be identified. The specific SIDS DRR-CCA risk governance framework utilised to generate the prospects is identified from literature. Data from documents, surveys and in-depth semi-structured interviews with 30 representatives from 20 organisations operating at different levels were gathered on DRR and CCA risk governance in Barbados from November, 2014 to May 2015. Analysis was carried out using document analysis, thematic analysis; social network analysis, and descriptive statistics.

The research identifies that SIDS require an enhanced risk governance framework for DRR-CCA. This framework has a systemic approach at the core, as well as an explicit development approach supported by a joined-up governance approach. Furthermore, risk assessments should include assessments of adaptive capacity. Existing potential for DRR-CCA risk governance was identified in highly dense networks, established disaster management networks, and a unique polycentric network that engages intraregional partners in national governance. Notwithstanding, challenges related to cohesion within and across institutions and sectors; missing community and socio-economic participation; as well as issues connected to unadjusted mind-sets to address the DRR paradigm shift in practice, and limited development-socio-ecological systems approaches, meant that the prospects identified mainly addressed these shortcomings. A spatial methodology for DRR-CCA seemed feasible.

This research contributes a framework for conceptualising DRR-CCA risk governance in SIDS which could be applicable to others. It offers a Caribbean SIDS perspective and practical suggestions for DRR-CCA that are relevant to SIDS practitioners and donors. Further research should focus on testing the prospects across the varying governance contexts of SIDS.
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I also wish to acknowledge the Commonwealth Secretariat for fully funding my studies and also the Government of Barbados for electing me to do it. I couldn’t do it without you. Also I wish to acknowledge the supervisory support provided to me by Professors Sarah Lindley and Richard Kingston, your guidance has been invaluable.
DEDICATION

This thesis is dedicated to Almighty God. Without Him I would not have started or finished this thesis.

Dear God, I thank you for your amazing grace.
THE AUTHOR

Prior to commencing the PhD the author spent almost eight years working in the field of disaster risk management and climate change in the Caribbean. Most of her experience was gained working for a Caribbean intergovernmental disaster management organisation. She has collaborated with several multilateral organisations and sectors, implementing projects across the 18 member states of this organisation. Her last project looked at mainstreaming climate change adaptation into disaster management - the first project of its type for the eastern Caribbean. This project was the catalyst for this PhD. Two years prior to commencing the PhD the author worked at the national level in the Barbados emergency management organisation where she had the responsibility for the climate change and disaster mitigation portfolio. The candidate possesses a BSc in Biology and a Masters in Geographic Information Science for Development and Environment.
This research originated from the researcher’s practical experience in Caribbean SIDS implementing a flagship Caribbean Disaster Emergency Management Agency (CDEMA) project on DRR and CCA called Mainstreaming Climate Change Adaptation into Disaster Risk Management for the Caribbean Region (CCDM Project, http://cdema.org/ccdm/). Here it was observed that project interventions in integrating the DRR and CCA were mainly led at the supranational level by the Caribbean Community (CARICOM) with seemingly little effect on risk reduction at the national and local level. Though important policy and programming directions on DRR-CCA had been achieved, and some awareness had been built on DRR-CCA for community and national planning, the scale of operation at the national level to influence transformation in risk reduction had been limited. Limitations identified in the project’s evaluation report, highlighted challenges with respect to resources and disconnections in the governance framework at the supranational, national and local/community levels. Subsequently, it was also observed that there was a gap with respect to the incorporation of the theory surrounding DRR-CCA into the policies, plans and tools being developed. Moreover there was little focus on DRR-CCA frameworks in practice for the integrated governance (assessing, evaluation, implementation and decision-making) of risk.

These challenges identified in eastern Caribbean SIDS were also applicable to Pacific SIDS. There were notable inroads in DRR-CCA at the strategy, planning as well as at the institutional level (UNISDR and UNDP, 2012), but little integration of the management of DRR and CCA issues in day-to-day practice (Gero et al., 2011). Integration in day-to-day practice could serve as one of the greatest potentials for realising tangible and sustainable reductions in risk. Most of the research on SIDS and DRR-CCA has centred on the Pacific experiences there has been little investigation of Caribbean SIDS like Barbados; and a gap globally on practical examples for how to advance with DRR-CCA.

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1 In the SIDS the use of regions within the country as an administrative boundary is not common. Larger countries like Jamaica use ‘regions’ but there is not a lot of administration at this level. Administration is mainly at the national, local and/or community level.
CHAPTER 1. THE EMERGENCE OF A SIDS CASE FOR INTEGRATING DISASTER RISK REDUCTION AND CLIMATE CHANGE ADAPTATION IN PRACTICE

The big issue . . . is global warming, climate change. We are having systems affecting us outside of the normal rainy season and the normal hurricane season
- Former Caribbean Community (CARICOM) Chairman and Prime Minister of St. Vincent and the Grenadines, Dr. Ralph Gonsalves, 2014

If what we are seeing and hearing in terms of climate change impact simply put is, disaster and eminent disaster, we still need to put whatever framework in place to ensure that we can minimize whatever risks they are... there is [a] need for greater integration.
- Interviewee in Barbados, 2015

1.1. THE OPPORTUNITY FOR CLIMATE CHANGE ADAPTATION AND DISASTER RISK REDUCTION INTEGRATION IN SIDS

The very existence of Small Island Developing States (SIDS) is under threat from future disasters and climate change (Nurse et al., 2014; UNISDR, 2015a). SIDS stretch across three ocean regions of the Caribbean; Africa, Indian Ocean, Mediterranean and South China Sea (AIMS); and the Pacific Ocean (Pelling and Uitto, 2001). They are a specially designated group of the United Nations (UN) (Hein, 2004) that have a disproportionate concentration of disaster risk (UNISDR, 2015a). SIDS are expected to lose up to 20 times more of their capital stock each year from disasters than regions such as North America, Europe and Central Asia (UNISDR, 2015a). In addition, it is expected that climate change will magnify disaster risks associated with coastal erosion, inundation, tropical cyclones and fresh water and agricultural land salinization (IPCC, 2013). Furthermore, it is anticipated that increases in temperature associated with climate change, will affect crop yields, water availability; and will impact life-sustaining ecosystems such as coral reefs, which are already living near the limit of thermal tolerance in many SIDS (Nurse and Moore, 2007). In view of these disaster and climate related threats to SIDS, this thesis focuses on two approaches that can aid SIDS in their response to this potential crisis- Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA). It looks specifically at how the two could be integrated, using the case of Barbados, a Caribbean SIDS.

Integration seems particularly beneficial to SIDS since both DRR and CCA seek to reduce vulnerability and enhance resilience (Venton and La Trobe, 2008) and linking can bring co-benefits (O’Brien et al., 2006; UNISDR, 2013). DRR and CCA will both be important strategies towards achieving global sustainable development targets. Particularly,
By 2030 build the resilience of the poor and those in vulnerable situations, and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters (Sustainable Development Solutions Network (SDSN), 2012, Target 1.5)

Integration in particular could benefit SIDS because it is a logical approach to reducing drivers of vulnerability (UNISDR, 2013) that are associated with the imminent climate related risks that they face. Integration would also promote effectiveness and efficiency in the use of resources for reducing risk (Schipper, 2009; Mercer, 2010); support practical approaches to reducing risk (Mercer, 2010), as well as strategic and holistic development interventions (Venton and La Trobe, 2008; Mercer, 2010; CDEMA, 2011; Chatterjee and Mitchel, 2014; Lei et al., 2014a).

Research has started to develop frameworks for conceptualizing DRR-CCA integration (Ahrens and Rudolph, 2006; Djalante et al., 2013) and has made links to processes such as vulnerability assessment (Birkmann et al., 2013). Nevertheless there have been challenges around translating the burgeoning knowledge on DRR-CCA integration into tangible and practical action (Shaw et al., 2010; UNISDR and UNDP, 2012). As a result, research has also examined the issues around practical implementation. These include unmistakable differences in, terms of origin, terminology, types/sources of knowledge, institutions and scales (Birkmann and von Teichman, 2010; Glantz and Baudoin, 2014) (see section 2.6). To this end, parallel institutions and strategies for DRR and CCA in practice persist. In some cases there seems to be a focus on preserving mandates regardless of the implications for efficiency and effectiveness from DRR-CCA integration. For example, the UNISDR Sendai framework, which is the global blueprint on addressing DRR, makes it clear that,

‘Addressing climate, while respecting the mandate of the United Nations Framework Convention on Climate Change, represents an opportunity to reduce disaster risk in a meaningful and coherent manner throughout the interrelated intergovernmental processes’ (UNISDR, 2015b, p.11).

Parallel processes however, would seem to be least beneficial to SIDS given their limited resources. Instead, DRR-CCA integrated approaches are urgently needed that address the root causes of vulnerability (Kelman, 2013) among other benefits of efficiency and strategic intervention. Regardless of the potential benefits of integration, the problem of separate global agendas persist (Kelman, 2015), and this informs related separate national institutions and agendas for DRR and CCA. It is therefore not surprising that DRR-CCA in practice, also
referred to as the day-to-day procedures for managing risk, has been limited and ad hoc (Shaw et al., 2010; Gero et al., 2011; UNISDR and UNDP, 2012; Rivera et al., 2015). The outlook for integration has also been painted as quite bleak given the present lack of information on how to go about integration. Furthermore moving from the academic discussion to practice; and additional challenges related to a society that is still largely grappling with response approaches rather than risk reduction, suggest that to add another layer to reducing risk through climate change adaptation would be unsuccessful (Gall et al., 2014).

As in other parts of the world, SIDS have had limited progress with integrated DRR-CCA approaches to managing risks in day-to-day procedures. SIDS have developed plans, strategies and institutional adjustments that address integrated DRR-CCC. For example, DRR and CCA have been institutionalised under one entity in The Federated States of Micronesia (FSM) (UNISDR, UNDP, 2012). In Caribbean SIDS, climate change and DRR have been incorporated as cross cutting themes of intra-regional frameworks for DRR and CCA. Specifically this has been done in the Regional Framework for Achieving Development Resilient to Climate Change 2011-2025, that is coordinated by the Caribbean Community Climate Change Centre (CCCCC) (CCCCC, 2011). The CCCCC coordinates the Caribbean region’s response to climate change. Similarly, the Comprehensive Disaster Management (CDM) Strategy and Framework 2014-2024 that is brokered by the Caribbean Disaster Emergency Management Agency (CDEMA) takes a cross cutting thematic approach to DRR-CCA (CDEMA, 2014). CDEMA is the regional inter-governmental agency for disaster management in the Caribbean Community (CARICOM²). Notwithstanding these important achievements for integrated DRR-CCA, more is needed to move towards an integrated approach to how risk is managed on a daily basis. It is anticipated that this could realize critical, tangible and sustainable reductions in risk, since this has been a particular area of weakness (UNISDR, 2015a). The critical risks associated with climate change and extreme natural hazard events, that threaten SIDS existence, present an urgent opportunity to maximise the benefits of an integrated approach to DRR-CCA.

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² CARICOM is a grouping of twenty island nation States. Since 1973 CARICOM has been the main organ of regional integration in the English speaking Caribbean. It focuses on four main pillars of integration: economic integration; foreign policy coordination; human and social development; and security. [http://caricom.org/about-caricom/who-we-are](http://caricom.org/about-caricom/who-we-are)
From the perspective of SIDS, useful tools that facilitate planning for risks in day-to-day procedures have been developed but do not provide an integrated and overarching governance approach to the risk decision-making process. Furthermore, they only provide limited consideration of SIDS development peculiarities. As such, SIDS could be on a defective pathway towards managing their risks. Examples include the Risk Management Guidelines for Decision Makers (developed and adapted from the Canadian Standards Association 1997 CAN/CSA-Q850-97 for the Caribbean); the Pacific AS/NZS ISO 31000:2009 (CARICOM, 2003; CCCCC, 2011); and the Caribbean Climate Online Risk and Adaptation Tool (CCORAL) (CCCCC, 2013) (see section 2.7). SIDS tools and approaches must be enriched to incorporate research on DRR-CCA in risk governance that responds to their peculiar context. This thesis therefore contributes a SIDS perspective on how integrated DRR and CCA could be achieved in practice.

It specifically examines how the SIDS context could condition the risk decision-making approach to DRR-CCA integration, which has not been previously researched. SIDS development characteristics of: high exposure to natural hazards; fragile biodiversity systems; small and fragile economies that are extremely vulnerable to collapse from external shocks; and small populations (Briguglio, 1995) seem to play a role in increasing risks to disasters and climate change impacts. The Intergovernmental Panel on Climate Change (IPCC) and the United Nations International Strategy on Disaster Risk Reduction (UNISDR) have also dedicated special reports to SIDS (Mimura et al., 2007; Wright, 2013; Nurse et al., 2014; UNISDR, 2015a). Interestingly also, almost half of the goals in the recent sustainable development goals specifically address SIDS. This thesis examines whether SIDS require a novel approach to integrated DRR-CCA in risk decision making in practice. Specifically, the aim of the thesis is to evaluate the prospects for establishing an integrated disaster risk reduction and climate change adaptation (DRR-CCA) development decision-making framework for Barbados as a SIDS. This is informed by an examination of how DRR-CCA integration might be conceptualised in the SIDS context; and how SIDS characteristics in the case of Barbados could be conditioning the challenges faced and potential for DRR-CCA. It builds on these findings to suggest prospects for Barbados and implications for other SIDS. A contribution is also made to the wider field on DRR-CCA integration in practice. Table 1-1 summarises the research objectives, questions and related sub-questions. In the subsequent chapter further background on the research’s rationale for focusing on Barbados as a SIDS is presented. This is followed by an explanation of the background for each of the four research questions identified for addressing the overarching aim of the thesis.
**Aim:** To evaluate the prospects for establishing an integrated disaster risk reduction and climate change adaptation (DRR-CCA) development decision-making framework for Barbados as a SIDS.

**Overarching Research Question:** What are the prospects for establishing an integrated disaster risk reduction and climate change adaptation (DRR-CCA) development decision-making framework for Barbados?

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<th>Objective 1</th>
<th>Research Questions:</th>
<th>Sub-Questions</th>
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<tr>
<td>To develop a conceptual framework for integrating DRR and CCA risk governance decision-making processes in SIDS</td>
<td>1. How can a framework for integrating DRR and CCA risk governance be conceptualised for SIDS?</td>
<td>What are the SIDS features that the risk governance framework should respond to?</td>
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<td>What are the requirements for DRR-CCA integration for a risk governance framework?</td>
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<td>How could a risk governance framework incorporate the peculiar development characteristics with which SIDS are associated?</td>
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<th>Objective 2</th>
<th>Research Questions:</th>
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<tr>
<td>To evaluate the extent to which existing DRR and CCA institutional structures and processes in Barbados already exhibit the potential for DRR-CCA integrated risk governance.</td>
<td>2. How do existing DRR and CCA institutional structures and processes in Barbados exhibit the potential for integrated risk governance?</td>
<td>What are the existing DRR and CCA risk governance institutions and processes in principle and practice?</td>
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<td>How are features of integrated DRR-CCA exhibited in structures and processes for risk governance in principle and practice? What is the potential shown by interactions and interconnections across structures and processes for integrated risk governance as revealed by social network analysis?</td>
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<th>Objective 3</th>
<th>Research Questions:</th>
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<td>To analyse the challenges to successful DRR-CCA risk governance in Barbados as a SIDS.</td>
<td>3. What are the DRR-CCA risk governance challenges in Barbados, as a particular SIDS context?</td>
<td>Why do DRR and CCA risk governance challenges occur?</td>
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<td>How does islandness influence them?</td>
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<th>Objective 4</th>
<th>Research Questions:</th>
<th>Sub-Questions</th>
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<td>To make recommendations to the Government of Barbados, and policy making organisations working to address DRR and CCA in SIDS.</td>
<td>4. What are the prospects for a DRR-CCA development decision-making framework for Barbados?</td>
<td>What are the policy and practical implications of the research findings for Barbados and implications for SIDS?</td>
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1.2. AN OVERVIEW OF BARBADOS, ITS RISK AND POLICY RESPONSES

As mentioned at section 1.1, this thesis looks at the SIDS case of Barbados. Barbados is one of the 29 to 48 designated SIDS. The number of countries that make up the SIDS grouping varies depending on the political affiliation (Hein, 2004). Some countries listed are not islands or independent states and there is ambiguity in terms of how smallness is defined (UNCTAD, 2004). In fact there is no agreed designation for SIDS (UNCTAD, 2004). Barbados however is a SIDS regardless of the designation used. It is a single island Caribbean SIDS, located at 13°10 N, 59°32 W. Barbados is 431 km$^2$ in area only, with a population of 277,821 (according to 2001 census figures). Comparatively Nauru, which is the smallest SIDS, has an area of 21 km$^2$, whereas one of the largest SIDS, Solomon Islands is 28,400 km$^2$. From a population perspective, Barbados is just below the average population for SIDS (9.Appendix 1). Like several SIDS, for example Antigua and Barbuda, Fiji and the Maldives, Barbados’ economy is highly dependent on tourism (Mahon and Becken, S. and Rennie, 2013). Tourism is responsible for 40% of Barbados’ GDP (WTTC [World Travel and Tourism Institute], 2017).

Barbados’ cocktail of natural hazards may differ slightly from other SIDS since it is a considerably flat, non-volcanic island with elevations ranging from 0 m along the coast to the highest point inland, called Mount Hillaby, which is located at 340 m above sea level (GOB (Government of Barbados), 2001). Based on its geomorphology it may be classified as an emergent limestone island as opposed to atolls or near atoll islands, or continental fringe islands (Forbes et al., 2013). It is surrounded by coral reefs. Barbados is predominantly a karst or limestone landscape. As a result, there are no permanent or major, rivers or lakes in Barbados. A few rainfall fed, streams, springs and ponds exist however these are seasonal (GOB (Government of Barbados), 2001). Notwithstanding these features, Barbados is highly at risk to climate change and disasters related with natural hazards. Primary threats to Barbados include, impacts from hurricanes and its secondary effects; flooding and landslides, earthquakes and industrial accidents or hazardous materials (Evanson, 2014). Overall annual expected losses to Barbados’ housing, infrastructure, tourism and services, based on the climate of 2009 is estimated to be 3% of GDP (CCRIF, 2010). Most of these losses would be due to hurricane induced wind damage (CCRIF, 2010). The UNDP ranks Barbados as highest amongst the SIDS for having the most urban produced capital and gross fixed capital formation at risk to pond flooding (UNISDR, 2013). Pond flooding or ‘pluvial flooding’ is the type of flooding that derives from direct runoff of rainfall water (overland flow) and is caused by the lack (or overcharge) of a natural drainage system (Abhas et al., 2012). It can lead to a number of secondary impacts such as vector borne and water borne diseases that can easily overwhelm national health systems and; it can also result in significant disruption to transportation and businesses (UNISDR, 2013).
Barbados’ climate change impacts include extremes in rainfall, temperature and sea level rise (GOB (Government of Barbados), 2001). Heavy and prolonged rainfall magnifies the risk to flooding due to low elevations and increased ground water levels. As sea level rises, so will the risk of coastal flooding increase (Day, 2010). The low elevation of the island together with the high density of the population, 25% of which live within 2km of the coast, has implications for exposure to flooding and the kinds of options for adaptation (Mycoo and Chadwick, 2012; Evason, 2014). Barbados’ water security is also threatened by sea level rise. Barbados is already a water scarce country (Reig et al., 2013), reduced precipitation and increased temperatures and associated drought (of undercharged groundwater aquifers) due to climate change are of particular concern (GOB (Government of Barbados), 2001; Cashman et al., 2010; Day, 2010). It is projected that the aquifers will be unable to support future demands for water in view of growing competition for water resources for residential and tourism purposes (Cashman et al., 2012). Furthermore, increased reliance on alternative water sources such as desalination have considerable implications for energy consumption (Cashman et al., 2012). Sea level rise (SLR) is also a particular threat to Barbados’ beaches which are very narrow- averaging 12m to 15 m. Barbados can expect some of the highest projections for sea level rise amongst the SIDS. It could experience sea level rise of up to 93 cm under the maximum IPCC scenario, A1F1 (Forbes et al., 2013). An elevated sea level is likely to increase beach erosion (Scott et al., 2012). Moreover it is estimated that 50% of tourist resort properties in Barbados are at risk to a SLR induced, 100 m coastal erosion scenario (Scott et al., 2012). This finding is quite significant noting that beaches are critical to maintaining tourist arrivals in Barbados. Prior to the actual erosion of the beach, gradual loss of the beach area would have significant implications for declined quality of the property, its value and competiveness (Scott et al., 2012). Were beaches to largely disappear, 77% of tourists would be unwilling to return to Barbados for the same price (Uyarra et al., 2005). Given the criticality of tourism to the Barbados economy, this would have significant impacts on the country on a whole. Even amongst Caribbean SIDS, the smallness of the Barbados economy, means that economic impacts from SLR when compared to other Caribbean states will be higher (Simpson et al., 2010).

The greater portion of SIDS ranks as either medium development or high development countries. Not many (at least 3) have attained very high development status, but Barbados has. It ranks no.54 in the world out of 188 countries on the UN Human Development Index (HDI) (UNDP, 2016). Overall the threats from disasters and climate change threaten hard won development progress to SIDS like Barbados. There is therefore an urgent need for steps...
to be taken to address risks to disasters and climate change. Notwithstanding its development achievements Barbados still has a number of poverty and health issues to be addressed that frame its vulnerability. Based on the most recent study on poverty and living conditions in 2010 (Country Assessment of Living Conditions, 2012), chronic Non-Communicable Diseases are the principal causes of morbidity and mortality 10.4% of Barbadians are at risk of slipping into poverty. The same report notes that extreme poverty exists amongst 9.1% of the population ($3,970 is the calculation of the “Indigence Line”). At the time of the 2012 report (2010 data) unemployment was highest amongst female headed households. 19.3% of the population existed below the poverty line (currently calculated at BDS$7,861 a year). Those living below the poverty line were mostly, single member households, usually pensioners, female-headed households and the youth. The report further highlighted that depth and severity of poverty in Barbados is greater in the urban than in rural areas. Furthermore there are also particular groups that are vulnerable to poverty, these include the sex worker, disabled, Rastafarian, gay, homeless, and persons with HIV/AIDS. Barbados’ economic recession at the time of the Country Assessment Report, was cited as a particular setback to reducing the existence of transient poverty. Since 2010, Barbados has undertaken a number of austerity measures to bring its economy back on track. Measures have included extensive layoffs in the public and private sector, as well as increased taxation. In 2013 the IMF concluded that the economy continued to face considerable economic challenges related to weak exports and tourism arrivals, slow growth, and expansive fiscal policy (Press Release by the IMF, 2013). Economic indicators of the challenges faced in 2013 were reflected in the decline in inflations, widening current account deficits, declines in private capital inflows, and fallen international reserves (See Table 1-2). In particular according to the Central Bank of Barbados strong international reserves are needed to ensure that the reserve buffer remains sufficient in order to protect the fixed exchange rate peg of the Barbados dollar (Press Release by the Central Bank of Barbados, 2017). As of September 2017, Barbados continues to struggle to service its external debt, and is failing to have major foreign inflows to offset those payments, which is contributing to a further decline in the level of international reserves. According to a recent press release by the Central Bank of Barbados,

*Despite moderate economic growth and policy-induced reduction in the fiscal imbalance, the Barbadian economy continues to face significant economic challenges.*

(Press Release by the Central Bank of Barbados, 2017, paragraph 3, p.4)
Figure 1-1 shows the downward trend in international foreign reserves for Barbados and Table 2 gives a summary of economic indicators that show the economic decline prior to 2013 and the present situation as at September 2017.

As Table 1-2 shows, the external debt service in 2013 was 6.4 and as of September 2017 it is 7.5. In 2013 foreign exchange reserves was BDS$1,457.7M (20 weeks coverage), compared to BDS$549.7M (8.6 weeks import coverage) in 2017. It is therefore anticipated that the poverty rating in Barbados has deteriorated since 2010 and will continue to do so as more austerity measures are put in place. According to the Central Bank of Barbados,

‘...The scale of fiscal and debt imbalances now requires significant structural reforms, related to the public sector financial management and improved tax administration.....’ (Press Release by the Central Bank of Barbados, 2017, paragraph 4, p.4)
It is therefore expected that more persons will slip below the poverty line.

It is notable that the recent evaluation of Barbados' economic performance highlights the string role that the tourism sector plays in boosting the economy as well as the deleterious effects of small scale disruptions related to climate extremes. The report notes that,

*Tourism output, which fuelled the stronger growth performance over the first half of the year, fell during the third quarter, due to a reduction in the average length-of-stay of visitors and hurricane-related disruptions to tourist arrivals in September* (Press Release by the Central Bank of Barbados, 2017, paragraph 1, p. 1).

In recent times, Barbados has suffered from several successive small events with the last devastating disaster in the early 1950s (Evanson, 2014). Unfamiliarity with disastrous events has resulted in a general complacency regarding DRR in Barbados (Caribbean Disaster Emergency Management Agency, 2010; Chmutina and Bosher, 2014). Notwithstanding, the efforts of the Barbados Government to reduce risks are notable. For example, having focused on emergency response for more than sixty years the Government adopted a comprehensive disaster management (CDM) policy in 2006 to address all phases of the disaster cycle (prevention, preparedness, mitigation and response), all hazards- natural and manmade with the inclusion and empowerment of all people (GOB (Government of Barbados), 2013b). It has also transferred some of its risk through the use of a regional parametric insurance scheme (Caribbean Catastrophe Risk Insurance Facility SPF) (CCrif SPC, 2015), from which it has benefitted in recent times. In addition, Barbados is a signatory to international as well as regional agreements that have influenced to some degree its commitments to addressing DRR and CCA; and invariably its shift from responding to disasters only to a more holistic approach. At the international level these include, the United Nations International Strategy for Disaster Risk Reduction (UNISDR) and the United Nations Framework Convention on Climate Change (UNFCCC). At the regional level, Barbados has adopted the Regional Framework for Achieving Development Resilient to Climate Change 2011-2025 and the Comprehensive Disaster Management (CDM) Strategy and Framework 2014-2024 (CCCCC, 2011) that are brokered by the two CARICOM organisations with mandates for climate change and disaster management- CCCCC and CDEMA respectively. These frameworks are blueprints for mobilising DRR and CCA. The CDM Strategy in particular, emphasises 1) institutional strengthening at the national, regional and sectoral level to deliver the CDM
program, 2) knowledge management for fact-based decision-making, 3) Disaster resilience of key sectors of the economy, 4) operational readiness at regional, national, sectoral and local levels, 5) a clearly established and understood nexus between CCA and DRR and 6) enhanced community resilience (CDEMA, 2014). It is important to note at this juncture that disaster risk reduction in the Caribbean has not always taken a comprehensive disaster management approach. Like many other countries, DRR in the Caribbean has undergone a paradigmatic shift over the last two decades from a focus on response mainly, to one that is more comprehensive to focus on disaster risk reduction.

The region is still making the shift and so much of the governance arrangements to address disaster risk reduction are still quite embryonic (CDEMA, 2014). Notable progress in making the shift to DRR is an innovative regional CDM governance mechanism for consulting with multi-stakeholders for harmonised planning at the regional level. National replication of this arrangement is still to occur (CDEMA, 2014). The catalyst policy agreement for the shift from response to DRR in the Caribbean, as well as in other countries across the globe is recognised to be the International Decade for Natural Disaster Reduction (IDNDR) (Huttenlau and Stötter, 2011; UNISDR, 2015a). This declaration by the United Nations General Assembly designated the 1990’s as a decade in which the international community would give special attention to fostering international co-operation in the field of natural disaster reduction. During the IDNDR the UNISDR was formed (in 1999), as well as the Caribbean Disaster Emergency Response Agency (CDERA) (in 1991), the forerunner of CDEMA (established later in 2013).

For Barbados specifically, it was recognised that there would need to be a shift to broaden the mandate of the disaster management organisation; and to make a change from preparedness and response only, to a more comprehensive approach. During the decade however, Barbados was still spending a lot of infrastructure and resources on preparedness and response, and public awareness. Real movement towards the comprehensive risk reduction approach in terms of adjustments in the institutional frameworks, and policy articulations was however seen outside of the time of decade. Institutional adjustments by the Caribbean region’s leading disaster management agency- CDEMA then CDERA, as well as through global frameworks such as the UNISDR Hyogo Framework for Action (which emerged out of the world conference for disaster risk reduction) were influential in Barbados making needed institutional adjustments for DRR. Based on a personal communication with the former DEM director, the specifics of the shift began with the adoption of the CDM mandate that was brokered by CDERA, by the Government of Barbados. This was then the catalyst for a new organisation- the Department of Emergency Management (DEM) that would replace the then
disaster management agency, the Central Emergency Response Organisation (CERO). The outcome was a new policy that addressed the architecture needed to carry out its expanded DRR mandate. This encompassed CERO transitioning from a relief organisation to a disaster management organisation - the DEM. The adoption of the new legislation and change in name signalled that the paradigm was being shifted and that they were a number of other things that needed to be put in place. This happened simultaneously as CDERA also made its institutional adjustments to CDEMA (Judy Thomas, Personal Communication, January, 2015).

With respect to international climate change adaptation agreements, Barbados has a national climate change focal point, which is The Ministry of the Environment. It is critical for coordinating the national committee on climate change, through which it judiciously prepares national communications to the UNFCCC and biannual reports to the UNISDR on progress on implementation of the national strategy - e.g. Hyogo Framework for Action (HFA) progress reports (GOB (Government of Barbados), 2013b). It is however not clear how outside of national communications, international priorities filter down into national programming. For example the Cancun Adaptation Framework calls for, strengthening the knowledge base and system, improving climate-related data and information, undertaking actions such as adaptation planning and implementation, vulnerability and adaptation assessments. It includes the need for the identification of adaptation options as well as assessing financial needs, and strengthening of institutional capacities and enabling environments for adaptation.

Further policy attempts by Barbados to address its risk include, the adoption of a Growth and Development Strategy for the period (2013-2020) that identifies climate change and natural hazards as one of its first challenges to sustainable development. It sets out strategies under section 5.4.8, ‘building climate change and economic resilience’ (GOB (Government of Barbados), 2013c) p.87. A number of typical disaster management measures are included as part of the strategy to address climate change such as the updating of the building codes and retrofitting. Included in its top strategies is, ‘investing in both prevention and preparedness which are more effective, and less costly than recovery efforts’ (GOB (Government of Barbados), 2013a) p.88. This seems to be in line with recommendations that early action on climate change outweigh the costs, and provide a favourable growth strategy for the longer term (McBean, 2004; Stern, 2007). In addition, a number of adaptation measures including the development of a holistic approach that tackles interlinked vulnerabilities rather than each one in turn are identified. The Government further suggests that this approach would require, ‘sophisticated tools for decision-making that change attitudes towards risks and uncertainty, well before shocks hit’ (GOB (Government of Barbados), 2013a, p.88). A number of other organisations are listed in the plan with particular key roles of the Drainage Division which is
mandated to provide a sustainable drainage management and flood prevention system aimed at remediating the perennial flooding around the island, using appropriate personnel, equipment and technology to mitigate disaster flood risk. It also includes key roles for the Town and Country Development and Planning Office (TCDPO); which through its development planning control mandate ensures that development occurs in a manner to avert risk e.g. ensuring that buildings are disaster and drought proof via various planning approval requirements.

From a practical perspective, the Government has designated the management of disasters through legislation to the Department of Emergency Management (DEM). Additionally, recently it has dedicated $30 million in financing through the support (loan) of the Inter-American Development Bank (IDB), to implement a Coastal Risk Assessment and Management Programme (CRMP) through the Coastal Zone Management Unit another key institution of risk management. The Coastal Zone Management Unit (CZMU) is responsible for the protection, conservation and management of the coastal zone and marine resources. The CRMP seeks to incorporate DRR and CCA in development planning control and monitoring of the coastal zone (GOB (Government of Barbados), 2011). The programme aims to build resilience to coastal risks and emphasises the generation of risk information for climate related hazards including wind, coastal erosion, storm surge and related coastal flooding, inland floods, and other hazards that may affect the coastal area. These include earthquakes, tsunamis and oil-spills. Also through monitoring and management including a national integrated coastal risk information system (NCRIP). In addition, it focuses on building coastal infrastructure including expansion of shoreline stabilization infrastructure, the maintenance of essential ecosystem services i.e. shoreline stability, sand protection through reef rehabilitation, dunes and mangroves functioning as buffers to erosion; and institutional strengthening (GOB (Government of Barbados), 2011). There is a missing element here to transition to information over into the decision making process whilst there is a recognition that outputs of the programme will call for rationalisation of roles and responsibilities of existing agencies such as the Coastal Zone Management unit, the Department of Emergency management and the Town and Country planning Department. Prior to this programme, Barbados benefitted from a small scale intervention on building awareness on integrating DRR-CCA (CDEMA, 2011). The problem for Barbados is that it has not realised significant reductions in its risk, and climate change is increasing the risk. Furthermore, integrating DRR and CCA has not been a policy objective for Barbados. Barbados must seek to avoid or lessen its risks to disasters since it is unable to bear its own risk (IDB, 2010) even with its current transfers of risk through insurance. Barbados’ high rating for governance (World Bank, 2012)
and it’s central government structure presents an opportunity for this research’s novel investigation of the prospects for advancing with integrating DRR and CCA (DRR-CCA) in the context of SIDS. Barbados has been a leader amongst the SIDS in advocating for frameworks that address sustainable development. The first agreement for SIDS specific sustainable development- the Barbados Programme of Action was hosted by Barbados and adopted in 1994 (UN, 1994). Barbados may also be a leader in identifying SIDS specific prospects for integrated disaster risk reduction and climate change adaptation (DRR-CCA) in risk decision-making for sustainable development. The researcher’s positionality (see section 3.7.1) as a Barbadian and former practitioner in the SIDS risk reduction landscape could also help to unearth deeper issues for consideration that should shape an integrated approach to DRR-CCA for managing risks. This research therefore focuses on one Caribbean SIDS case, Barbados, for an in depth, examination of the prospects for integration and to extrapolate what may be applicable to other SIDS based on their similarities of smallness and islandness development characteristics. Lessons learnt from Barbados can inform national and international policies for managing risk in an integrated manner in SIDS.

1.3. CONCEPTUALISING INTEGRATING DISASTER RISK REDUCTION AND CLIMATE CHANGE ADAPTATION

As introduced in section 1.1 the rationale for DRR-CCA has been identified as well as benefits from integrating DRR-CCA. Additionally differences and similarities between DRR and CCA have been debated (Birkmann and von Teichman, 2010; Mercer, 2010). In order to identify the prospects for DRR-CCA integration in SIDS, an overarching framework is needed to conceptualise how DRR-CCA could be carried out in day-to-day risk management processes. Whilst there are a few frameworks for integrating DRR and CCA (Djalante et al., 2011, 2013; Forino et al., 2015; Birkmann et al., 2013), (discussed at section 2.7) none of these frameworks investigate the context of SIDS or how risk could be managed as a process. Research is highlighting (Gero et al., 2010; Djalante, 2013; Nalau et al., 2016) that DRR-CCA integration is hindered by governance challenges; however, how governance of the risk decision-making process could operate for DRR-CCA integration has not been investigated. A risk governance or risk decision-making perspective provides one approach to conceptualising the issue of DRR-CCA in practice in SIDS (this is discussed further at section 2). Frameworks that address risk governance however focus on one methodological aspect of the risk decision-making process. For example MOVE (Methods for the Improvement of Vulnerability Assessment in Europe (Birkmann et al., 2013) addresses vulnerability assessment only. Others do not address governance as is the case of the CRAM (Common Risk
Assessment Methodology) (Papathoma-Köhle et al., 2016). Furthermore other frameworks only address key questions in the decision-making process (Lei et al., 2014b) but do not provide a holistic integrated DRR-CCA risk governance framework. This thesis builds on previous research on DRR-CCA integration, and approaches for risk governance and therefore asks under the first objective, **how can a framework for integrating DRR and CCA risk governance be conceptualised for SIDS?**

Consequently, it examines, **what are the SIDS features that the framework should respond to?** This is based on the evidence that smallness and islandness features influence development and disaster and climate change impacts (as mentioned at section 1.1). It has not yet been determined whether there are particular features that an integrated DRR-CCA framework should respond to for governing risk. Having identified SIDS features for consideration in a DRR-CCA approach, the thesis examines the deeper question of, **what are the requirements for DRR-CCA integration for a risk governance framework?** This responds to the need for an overarching DRR-CCA integration framework for risk governance. Finally to develop the conceptual frameworks, it asks **how a risk governance framework could incorporate the peculiar development characteristics with which SIDS are associated.** This is based on the SIDS features identified.

### 1.4. DRR-CCA INTEGRATION SOLUTIONS - RESPONDING TO THE CHALLENGES AND MAXIMISING THE POTENTIAL OF THE SIDS CONTEXT

In view of the limited progress with integrating DRR-CCA in practice, research has been looking at some of the challenges that could prevent integration. This discussion around challenges to integration in practice has focused around governance (Dhar Chakrabarti, 2010; Gero et al., 2010; Howes et al., 2015; Rivera et al., 2015; Nalau et al., 2016). Examples include issues with coordination and communication, capacity, formal and informal norms, mismatches of terms and definitions, unavailability of information, as well as gaps with monitoring and evaluation mechanisms. Knowledge about how integration agendas might be progressed has also been growing, for example from, Australia (Howes et al., 2015), Mumbai-India (Dhar Chakrabarti, 2010), Cambodia, Nicaragua (Rivera et al., 2015), and the Pacific SIDS (Nalau et al., 2016) (see section 2.6). With respect to prospects for integration these have highlighted the need for linking DRR and CCA agendas, and addressing integration at multiple scales and across sectors (Birkmann and von Teichman, 2010; Djalante et al., 2013).
In addition, improvements to the information base have been a key aim (Birkmann and von Teichman, 2010; Djalante et al., 2013). As well as solutions that foster better coordination such as strengthened governance architectures; and improved capacity through public and private financing and structures and instruments that enable institutional and social learning, self-organisation and networking (Birkmann and von Teichman, 2010; Djalante et al., 2013). These prospects would seem to be applicable to most contexts for DRR-CCA integration, given the focus around common governance issues. What we do not yet understand is how country contexts may be shaping challenges and potential, and the extent to which it may shape solutions to DRR-CCA integration in day-to-day processes for managing risks. Often there are underlying issues that can debilitate attempts at improving governance. In the case of SIDS, though smallness and islandness are often associated with negative impacts (as introduced in section 1.1.), there is research that shows that there may be some positives (Adger et al., 2004; Petzold and Ratter, 2015). A deeper understanding of these issues is needed, this could help tailor solutions for integrated DRR-CCA thus making them more impactful and sustained. This is discussed further at section 2.3. Furthermore understanding these DRR-CCA issues from the perspective of risk governance calls for an examination of how risk governance institutions have developed, the inter-organizational networks, modes of work, and communication practice (Boholm et al., 2012). In this regard, under objective 2 of the thesis, the overarching question is asked, **how do existing DRR and CCA institutional structures and processes in Barbados exhibit the potential for integrated risk governance?** In asking this question it is recognised that there are existing governance structures and processes that show potential for DRR-CCA integration. Furthermore, while there may be legislation and institutional structures for DRR and CCA ‘in principle’ what may be practiced on a daily basis may be different. In order to get a better understanding of the potential, the ‘in principle’ and ‘in practice’ findings are therefore compared. The thesis therefore asks, **what are the existing DRR and CCA risk governance institutions and processes in principle and practice?** Following from this it asks **how are features of integrated DRR -CCA exhibited in structures and processes for risk governance in principle and practice?** As Boholm et al., (2012) suggest the inter-organizational networks, and communication practice are important for understanding how risk governance functions. Research from mainland contexts also indicates the importance of strong relationships between key government organisations in DRR and non-governmental and international organisations involved in both DRR and CCA. They hold the key to integration of policy and practice (Djalante, 2013). In particular, therefore, the practice of information sharing and collaboration concerning risk governance process networks for DRR-CCA is investigated. The thesis therefore asks, **what is the potential shown by interactions and interconnections across structures and processes for integrated risk governance as revealed by social network analysis?**
Building on the findings on these questions related to the potential for DRR-CCA, under the third objective, the thesis examines **what are the DRR-CCA risk governance challenges in Barbados, as a particular SIDS context?** It then follows up with a deeper assessment of, **why do governance challenges occur and how does islandness influence them?** In seeking to answer the latter question, it looks for clarity on the challenges with the aim of constructing solutions/prospects for DRR-CCA that respond to the SIDS case and the potential identified. This corresponds with the last objective of the thesis and the final questions that ask, **what are the prospects for a DRR-CCA development decision-making framework for Barbados?** More specifically, **what are the policy and practical implications of the research findings for Barbados and implications for SIDS?**

### 1.5. RESEARCH SCOPE

The aim of this thesis is, to evaluate the prospects for establishing an integrated disaster risk reduction and climate change adaptation (DRR-CCA) development decision-making framework for Barbados as a SIDS. Thus, it provides recommendations for how the DRR-CCA development decision-making framework could be established and not its actual establishment. The latter would require more time and resources than this PhD offered.

This research identifies DRR and CCA integrated actions as an investment because disasters and short-term events result in long-term setbacks to countries’ infrastructure and economic and social investments, which without the disaster, would have been much more successful. Although after a disaster, agencies and politicians are keen to allocate resources to the afflicted communities (Lagadec, 1990) this approach is inefficient and costly (UNISDR, 2013). Studies show that the recovery costs are also much more than costs necessary for risk reduction (UNISDR, 2013). Disasters perpetuate development problems and are typically associated with an immediate contraction in economic output, worsening of external and fiscal balances and an increase in poverty (Charvériat, 2000; Rasmussen, 2004; Mora, 2009). Disasters can destroy decades of capital investment as well as hard fought development gains; and are often followed by slow recovery (UNISDR, 2009). Furthermore, studies (Freeman and Warner, 2001; Hallegatte et al., 2007) show that the chronically vulnerable, will face significant barriers to short-term recovery and long-term development.
Consequently investing in risk reduction is beneficial, makes sense, is more effective and less costly than responding to disasters (Christoplos et al., 2001; Owens et al., 2003; Skoufias, 2003; UNISDR, 2004). Given the high vulnerability of SIDS, investment in DRR and CCA is likely to reap the greatest benefits (UNISDR, 2013). It has already been suggested that investing in DRR will most likely place SIDS in a better global position. It will give them the best opportunity to attract investment, strengthen resilience and improve competitiveness and sustainability (UNISDR, 2013).

The discussion of climate change adaptation as an investment is politically charged with arguments of ‘the polluter pays’ since though climate impacts to SIDS are projected to be significant, the Greenhouse gas (GHG) emissions from most small islands are negligible in relation to global emissions (Nurse et al., 2014). Nevertheless, SIDS are recognising that they can pursue ‘no regret’ adaptation actions. These actions would be beneficial with or without climate change such as enforcing building codes, sustainable land use planning and water conservation. Critical attention must be paid to considering the sensitivity of long-term investments in infrastructure and development to the effects of climate change and sea level rise (Veitayaki, 2010). Notwithstanding these arguments for DRR and CCA as investments, the required shift to anticipate risks in public and private investment remains a challenge for most governments (UNISDR, 2013) as response is still the priority. Effective investment in disaster management requires a cost management framework (Altay et al., 2013). It is also an important starting point for careful evaluation of climate change response strategies (Wilbanks and Sathaye, 2007). However, cost-benefit analysis of the DRR and CCA investments is beyond the scope of this thesis. The scope of the investment discourse in this thesis is meant only in terms of an integrated DRR-CCA framework itself, within which formal cost-benefit assessments would sit.

The other defining scope of the research is with respect to the SIDS to which the findings may be applicable. Whilst this thesis focuses on Barbados, the findings may be applicable to other SIDS that meet the criteria of smallness, islandness, developing and stateness (discussed at section 2.2). Not all countries listed as SIDS correspond with these features. SIDS that do, include, Antigua and Barbuda, Bahamas, Cape Verde, Comoros, Dominica, Fiji, Grenada, Jamaica, Kiribati, Maldives, Marshall Islands, Federated State of Micronesia, Mauritius, Nauru, Palau, Samoa, Sao Tome and Principe, Seychelles, Solomon Islands, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Timor-Leste, Tonga, Trinidad and Tobago, Tuvalu, and
Vanuatu. They are also part of the United Nations Conference on Trade and Development’s (UNCTAD) pragmatic list\(^3\) of SIDS (Encontre, 2004), with the exception of Papua New Guinea which in the year 2000, surpassed the 5 million population limit- its population is estimated at 7,059,653. Others like Bahrain, which is still identified as a developing country though with a very high development status, could also be included. Some SIDS excluded are members of the political group, Alliance of Small Island States (AOSIS) such as Belize, Cook Islands, Cuba, Dominican Republic, Guinea-Bissau, Guyana, Haiti, Niue, Singapore, and Suriname, which may not be islands, small nor developing. The UN includes a number of other SIDS including Aruba and Puerto Rico, which are not sovereign nations. See Hein, (2004) for more details.

1.6. STRUCTURE OF THE THESIS

This thesis is presented as a journal format. Each paper and its respective objectives build upon the other. The thesis is presented in three parts with seven chapters. Part 1 (Chapters 1, 2 and 3) consists of the introduction, key concepts, literature review and a critical review of the methodology applied. In Part 2 (Chapters 4, 5 and 6), the results which are three papers are presented. Finally, in Part 3 (Chapter 7), a discussion and summary of the research findings against the objectives is presented.

Chapter 2

In the next section the literature on the key concepts, frameworks, challenges and prospects including decision making tools for integrating DRR-CCA are critically discussed with a focus on how the concepts have shaped the thesis.

Chapter 3

Following this, an overview of the research strategy, paradigm and design; and the methodological perspectives are presented. It includes a critical analysis of the methods used and the information they provided, as well as a section on ethics.

\(^3\) ‘...the UN never established criteria to determine an official list of SIDS. In this context, UNCTAD, for analytical purposes, uses an informal list of 29 SIDS. Since the early 1990s, UNCTAD has been supporting the plea for putting the issue of vulnerability at the heart of UN attention to the problems of SIDS’ http://unctad.org/en/Pages/ALDC/Small%20Island%20Developing%20States/UN-recognition-of-the-problems-of-small-island-developing-States.aspx.
Chapter 4, Chapter 5 and Chapter 6

Thereafter, three results chapters are presented which are the three papers associated with each research objective, that are based on the findings and analysis:

Paper 1- A Conceptual Framework for Integrated Risk Governance of Disaster Risk Reduction and Climate Change Adaptation in Small Island Developing States (Chapter 4). This paper has been submitted to the International Journal of Disaster Risk Reduction. It has been peer reviewed, and is being revised for resubmission.

Paper 2- Does smallness help? Social networks and connectedness in Disaster Risk Reduction and Climate Change Adaptation in Barbados, a Small Island Developing State (Chapter 5); and

Paper 3- Challenges to successful Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA) integration in SIDS: Evidence from Barbados (Chapter 6). This paper has been submitted to Island Studies Journal as part of the Special Issue, Small Island Perspectives on Climate Change. It has been peer reviewed and is being revised for resubmission (Greenidge et al., n.d.).

Chapter 7

Thereafter a concluding discussion chapter is presented that draws the various outcomes of the research together, and discusses the prospects for establishing an integrated disaster risk reduction and climate change adaptation (DRR-CCA) development decision-making framework based on the findings that emerged from the research. This includes reflection on the policy and practical implications of the research findings for a DRR-CCA development decision-making framework for Barbados and other SIDS. It concludes with the contribution of the main findings to knowledge and scholarship, the methodological limitations of the study, and recommendations for future research.
1.7. CONTRIBUTION OF AUTHORS

The candidate has contributed all ideas presented in the thesis. Co-authors have contributed to, structuring, organising and clarifying of the ideas presented. All researched materials are the result of original research undertaken after the date the candidate initially registered with this University.
I sat at one of these world conferences and could not help but think that, the world is getting it wrong not just Barbados. Lots of money being poured into climate change adaptation but you really can’t isolate the two of them [disaster management and climate change adaptation].

- Interviewee in Barbados, 2015

2.1. INTRODUCTION

This chapter reviews key theories on risk and vulnerability, as well as concepts on smallness, islandness, stateness, governance, and risk governance. It also reviews how they were applied to address the aim of the research. Previous research on integrating DRR and CCA, as well as the challenges and prospects for integrating DRR and CCA are also reviewed. Special attention is given to decision-making frameworks and the potential prospect offered for DRR-CCA. The concepts and literature presented in this chapter form the basis for the papers presented. Each paper also provides a deeper assessment of the literature that informed this work.

2.2. THEORIES OF RISK, VULNERABILITY, RESILIENCE AND SYSTEMS

Fundamental to the prospects for integrating DRR and CCA is a belief that, risk can be managed. This is because in this thesis risk is understood from two main perspectives. Firstly, risk is objective regardless of the social circumstances (realist perspective). Secondly, risk can be directly controlled by social constructs or mediation (constructivist perspective).

From the realist perspective the thesis applies the definition of risk as a hazard, loss, damage or threat of an unwanted event (Zinn, 2006). As such the hazard risk may be a calculated probability and associated with this, the extent of damage of that event may be measured in terms of lives lost, infrastructure, and services. This is the technical definition of risk as applied in the engineering discipline for example. Hence the equation:

\[
\text{Risk} = \text{Probability (event)} \times \text{Damage (event)}
\]

These kinds of calculations are essential in the hazard estimation stage of the risk governance approach (discussed further at section 2.5). Notwithstanding, this thesis also corresponds with a social science understanding of risk. Generally seven approaches to understanding risk
may be taken: 1) Psychometric, 2) Systems theory, 3) Governmentality by Foucault (1991), 4) cultural turn (by Douglas (1982) and Lupton and Tulloch (2002)); 5) Sociocultural theory (Paul Slovic (1999)), 6) Risk society (Niklas Luhmann, (1982); Ulrich Beck (1999), and 7) Edgework (Lyng, 1990). This thesis accepts the argument that development choices can increase disaster risk (Wisner et al., 2004). To this end, the theory of risk society is used to understand what risk is. In this theory, risk is a construct of physical and social dimensions. In addition, it adopts psychometric and governmentality theories which also provide other perspectives on ‘what risk is’, that are useful to this thesis. Using these theories, risk is the product of perceptions, values, different rationalities, power, and emotion. Risk society however is the dominant theory applied. It fits with common expressions of risk in disaster risk reduction (Wisner et al., 2004; UNISDR, 2009a), where risk is the function of the hazard, exposure and underlying drivers of vulnerability. Other descriptions that fit this theory, describe risk therefore as a function of the hazard (H), exposure (E), and vulnerability (V) (Crichton (1999). Where:

Hazard is:

*A dangerous phenomenon, substance, human activity or condition that may cause loss of life, Injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage.* (UNISDR, 2009a, p.17)

Exposure is:

*The situation of people, infrastructure, housing, production capacities and other tangible human assets located in hazard-prone areas.* (UNISDR, 2009a, p. 15)

Vulnerability is:

*The characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard.* (UNISDR, 2009a, p.30)

Or

*The characteristics of a person or group and their situation that influence their capacity to anticipate, cope with, resist and recover from the impact of a natural hazard (an extreme natural event or process).* (Wisner et al., 2004, p. 11)

Other equations incorporate capacity (C), as the degree to which one has the ability to protect oneself, and to cope with hazards, as a function of risk (Uitto and Shaw, 2006). This is
represented by the equation: \( R = f (H, V, C) \), calculated as \( R = \frac{H \times V}{c} \). Furthermore, mitigation (M), the ability of government agencies and other groups to lessen the impacts of a hazard and to prepare for hazard events can also be incorporated in the risk equation, in the form: 
\[
R = \left( \frac{H \times V}{c} \right) - M
\]
(Uitto and Shaw, 2006). In addition, as will be discussed at section 2.3.3 social capital could also influence capacity and from the climate change perspective it also impacts adaptive capacity. Where

Adaptive Capacity is the ability or capacity of a system to modify or change its characteristics or behaviour so as to cope better with existing or anticipated external stresses. (Adger et al., 2004, p.34)

And

Social capital is the, networks and relationships between individuals and social groups that facilitate economic well-being and security (Adger et al., 2004, p.35).

Or from a risk governance perspective,

Social capital is strong institutional mechanisms and transparency in decision-making, formal and informal networks that promote collective risk handling, education and decision-making power that is assigned. (Klinke and Renn, 2012, p.278)

Thus far, the thesis discussed capacity as the ability to undertake mitigation, and the ability or capacity to cope and protect (according to Uitto and Shaw, 2006). Furthermore, the definition of adaptive capacity also addresses capacity from the perspective of being able to modify or change in order to cope better (according to Adger et al., 2004). Each of these definitions addresses key components of what others have defined as resilience. Resilience is a highly contested term for which there is no one agreed definition (Manyena et al., 2018). In fact, more than eighty definitions may be found (Manyena et al., 2018). Notwithstanding, a commonality amongst the definitions is that resilience is about capacity to do something positive (Manyena et al., 2018). The term resilience addresses the gaps in the concept of vulnerability which does not acknowledge that persons affected by disasters have agency and capacity (Twigg, 2009). Resilience has been summarised to consist of five core capacities- 1) preventative 2) anticipative, 3) absorptive, 4) adaptive and 5) transformative (Manyena et al., 2018) (See Figure 2-1: The Five capacity components of Resilience. modified from (Manyena et al., 2018). This concept that resilience is only about capacity is debated because it goes beyond specific behaviours and measures for DRR that are normally understood as capacity (Twigg, 2009). Nevertheless, capacity is part of the everyday usage of the word resilience and in many of the academic definitions of resilience, and this is the main understanding of resilience used in this thesis.
Based on what has been discussed so far in terms of the context of risk, and that is affected by the ability for mitigation, capacity to cope and protect, in the risk function I suggest that capacity elements of the risk equation reviewed, relate to the preventative and absorptive capacities of resilience and also relate to the anticipative elements to some degree. Therefore risk can be understood as a function of resilience, vulnerability and exposure. Furthermore the anticipative aspects of the resilience, core capacities, are also captured in risk as a function also of adaptive capacity. It would seem however that the transformative aspects of resilience are not specifically captured in the risk constructs reviewed so far. However transformative capacity is particular essential in the context of climate change which is changing baseline vulnerabilities and systems. For the purpose of this research that addresses risk from the climate change and disaster risk perspective, risk is understood as a function of vulnerability, exposure and resilience. Based on the discussion of resilience reviewed, resilience could also be understood to affect vulnerability and lack of resilience increases risk. Increased resilience decreases risk. With respect to vulnerability specifically, the lack of resilience to prevent and absorb (cope, recover), and anticipate has been seen as a component of vulnerability (Birkmann et al., 2013) (the reactive aspects) as will be discussed. There are however other components of resilience: adaptive, and transformative aspects that are not accounted for (the more pro-active aspects) in a vulnerability understanding of resilience; but that also affect risk related to DRR and CCA (Birkmann et al., 2013). Besides resilience meaning capacity, this research also acknowledges that it can also mean the end-
point or the result of implementing disaster risk reduction actions (Twigg, 2009). This end-point (or goal) idea is reflected in frameworks such as the former Hyogo Framework for Action, the CDEMA CDM Framework and now the Sendai Framework which is investing in disaster reduction for resilience (UNISDR, 2015b). The end-point has been argued to be about building resilient communities, building resilient well-being, and resilient development rather than resilience to risk (Twigg, 2009). Many of the indicators of resilience therefore reflect measures of DRR (Twigg, 2009; Manyena et al., 2018). In summary resilience is a component of reducing risk as well as the end-point of reducing risk. From the endpoint perspective it is the product of vulnerability and actions taken to mitigate these (Pelling, 2011). As a component of risk it is understood as,

Resilience: The ability of a system, community or society exposed to hazards to resist, absorb, accommodate, adapt to, transform and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions through risk management. (UNISDR, 2017, ‘resilience’)

In section 2.3.3 this concept of resilience is applied when discussing the potential that smallness may offer SIDS in terms of resilience.

In addition to the resilience component of risk, borrowing from some of the elements of psychometric theory, the role of perception in constructing risk is addressed as an element of the risk governance framework. Perception can amplify or attenuate risk (Pidgeon et al., 2003). It should therefore be included as one of the factors influencing and constructing risk. So far, the main components of risk highlighted are, hazard, exposure, vulnerability, resilience and perception/ social concern. In some cases, however the definition applied for vulnerability particularly in the case of DRR-CCA approaches suggests that rather than as standalone features, vulnerability can incorporate (1) exposure to a hazard or stressor; (2) susceptibility; (3) societal response capacities or lack of resilience and (4) adaptive capacities (Birkmann et al., 2013). Vulnerability is therefore understood to be constituted of these key factors, it also has thematic dimensions- such as environmental, physical and social aspects (Birkmann et al., 2013).

The way in which vulnerability is understood has implications for how risk is understood. In fact, vulnerability has several meanings (Füssel, 2007). This thesis applies a combined understanding of vulnerability that builds on concepts of vulnerability in the disaster and climate change disciplines. These concepts are helpful for framing an integrated approach.
For example from the DRR discipline the thesis builds on the UNISDR concept that emphasises the characteristics of the system, asset or community that make it susceptible (UNISDR, 2009a). In addition, drawing on Wisner’s definition of vulnerability, coping capacity is also incorporated in defining vulnerability (Wisner et al, 2004). Meanwhile from the climate change discipline it incorporates the IPCC’s concept of vulnerability as a hybrid of susceptibility and exposure to the natural hazard or physical event (IPCC, 2012b). On its own, this concept only gives a partial understanding of vulnerability. However, since this thesis focuses on vulnerability to DRR and CCA related threats, a combined understanding is more applicable. Vulnerability cannot only be the outcome or net damage for a given level of global climate change that results linearly from the exposure and the adaptive capacity of the unit (O’Brien et al., 2004, 2007). Both DRR and climate change disciplines have highlighted also that there are different dimensions of vulnerability that should be accounted for. Particularly in the climate change discipline the system is described as being multidimensional—exhibiting institutional, biophysical, socio-economic and technological dimensions. These dimensions interact dynamically with external and internal processes to the system (Füssel, 2009) (Figure 2-2). External processes not only include climate change but the wider threats including climate variability and for the purposes of this thesis other hazards. Besides this there are political and institutional structures, economic and social structures, as well as changes that impact the contextual condition of vulnerability and vice versa (Birkmann, 2006; O’Brien et al., 2007; Füssel, 2009; Lei et al., 2014a).

FIGURE 2-2: FRAMEWORKS DEPICTING TWO INTERPRETATIONS OF VULNERABILITY TO CLIMATE CHANGE: (A) OUTCOME VULNERABILITY; (B) CONTEXTUAL VULNERABILITY. SOURCE (O’BRIEN ET AL., 2007. P.75)
Somewhat similar to this contextual understanding of vulnerability is a DRR perspective that describes root causes and pressures that affect vulnerability and by extension risk. This is the Pressure and Release (PAR) model (Blaikie et al., 1994; Pelling and Uitto, 2001; Wisner et al., 2004). Figure 2-3 shows how this can be conceptualised for SIDS.

SIDS studies already suggest that socio-economic, and climate induced physical, and socio ecological conditions are shaping their climate vulnerability (Nurse et al., 2014). Such conditions could include issues such as a narrow resource base, fragile ecosystems and intricately connected livelihoods. From a disaster management perspective studies (Mercer et al., 2007; Mora, 2009) are highlighting how environmental processes, unsafe conditions related to the economy, social relations, the physical environment and intrinsic effects are shaping vulnerability. Intrinsic effects can include minimal organisation support, limited access to services, limited access to education, including hazard management and natural resource management and loss of indigenous knowledge (Mercer et al., 2007). Further factors affecting vulnerability particularly in developing countries including the Caribbean, highlight issues with unawareness and indifference of political support (Mora, 2009). Inadequate development models, and underestimation of risk has also been linked with unplanned land use that drives vulnerability to disasters upwards (Mora, 2009).
(2009) links these root problems with a number of outcomes such as inadequate capacity, population exposure and degraded environmental resources. The disregard for good practices and standards linked with obsolete construction codes are contributing to vulnerability in developing countries including SIDS (Mora, 2009). Often the threats from vulnerable construction are compounded by pressure from weak institutions and inadequate capacity (Mora, 2009). It is notable that many of the factors driving vulnerability in SIDS and other developing countries are related to governance. Therefore it is not surprising that key risk management and adaptation strategies for SIDS promote the improved management of island resources, as well as improvements to the risk knowledge (Nurse et al., 2014). Furthermore, in response to socio-economic deficiencies there are recommendations for strengthening of socio-economic systems and livelihoods (Nurse et al., 2014). A better understanding of the linkages between ecosystems and human societies can assist in vulnerability reduction particularly in coastal areas (Adger et al., 2005) and by extension risk reduction. This thesis takes a more encompassing governance approach and applies it to DRR-CCA. A multi-dimensional and dynamic understanding of vulnerability (Birkmann, 2006) is therefore applied that accounts for addressing the various vulnerability dimensions and interactions with the system. This approach therefore leads to identifying key stakeholders that have a role in framing and governing vulnerability and by extension risk. It also means that governance frameworks selected for DRR-CCA should be multi-dimensional. In addition, this multi-dimensional understanding of vulnerability underpins a concept of DRR-CCA that suggests that risk management (which is the final step of the risk governance process) (section 2.5) should be informed by an assessment of how the various dimensions of the system and community shape vulnerability in SIDS.

2.3. SMALLNESS AND ISLANDNESS

This research focuses specifically on SIDS. The designation speaks in particular to smallness, islandness, stateness and developing. These terms have implications for governance. Stateness implies sovereignty, independence and self-sufficiency; whereas the term developing country not only refers to stateness (sovereignty) but the level of development of the industrial base. It means that there is a low ranking on the HDI relative to other countries (O’Sullivan and Sheffrin, 2003). This thesis argues that stateness and developing county status have implications for the kinds of prospects for an integrated DRR-CCA risk governance framework. Stateness would suggest that a country is accountable for managing its risks, and its developing status implies that it may have limited supporting structures to implement risk governance. The thesis argues that the other two characteristics of smallness
and islandness could influence the kind of DRR-CCA risk governance model for SIDS. They are now discussed.

2.3.1. SMALLNESS

Smallness may be understood in terms of population size, geographic area and economic ability. UNCTAD and others such as the Commonwealth Secretariat suggest a population threshold of 1.5 million extendable to a 5 million limit that could be ascribed to being small (UNCTAD, 2004; Commonwealth-Secretariat, 2012). In this regard, the most populated SIDS is Jamaica (2,950,210 people) and the least populated is Nauru with approximately 10,000 people. Small population size limits the skills and human resources or the domestic market available. This has been termed demographic smallness (UNCTAD, 2004; Connell, 2013). Small population size also means that there are also high per capita costs for infrastructure and services (Nurse et al., 2014). Thus, smallness could affect how DRR-CCA is resourced. Secondly, smallness has also been interpreted in terms of geographic size. It has been applied to mean that there is an exceptionally larger coastal zone compared to land area (McCall, 1994). This has implications for exposure to hazard threats since there is often a concentration of the population in the coastal zone, and Barbados is no exception. As mentioned in section 1.2, 25% of the population live within 2 km of the coast (GOB (Government of Barbados), 2001). Smallness can also create additional pressures for sustainable development choices which are constrained by limited space that is often in fragile coastal areas (McCall, 1994). Moreover geographic smallness means that hazard events often affect most of the country, especially in the case of single-island states compared to larger countries (Anthoff et al., 2010). This has implications also for the extent of economic losses sustained. Individual events have a very large negative impact on the GDP of small states compared to larger countries where the impact on GDP is comparatively smaller (Anthoff et al., 2010). This disadvantage is also connected with the economic smallness of SIDS which has been heavily discussed in the literature (Briguglio, 1995, 2003; Mimura et al., 2007; Guillaumont, 2010). This smallness derives from their economic profile.

Economic “smallness” has often been utilised to explain the narrowness of the domestic financial base, and therefore the need for external financial assistance to implement costly public sector investment programmes, regardless of per capita income. It also includes having few opportunities for economies of scale, high dependency on external influences and linkages for financial support and trade among others. Some of these issues arguably are not inherent smallness issues attributable to the state itself, but are the result of unequal power structures that are conditional and politically challenged on the world market (Lee and Smith,
It is still essential however to recognise the limitations of small economies in the context of this research and the source of some of the challenges, as more realistic solutions could be suggested for DRR-CCA. Other smallness issues such as, excessive dependence on aid and imports, small domestic markets and capital, limited diversification of their economies, can further limit resources available for DRR and CCA (Nurse et al., 2014; UNISDR, 2015a). While SIDS do differ in terms of the type of specialisation of the economy—whether tourism in the case of Barbados, agriculture in the case of Vanuatu, or are export concentrated, their economies are highly exposed to shocks and natural hazards (Easter, 1999; Liou and Ding, 2002; Turvey, 2007). Narrow export specialisation exposes their economies to real shocks of intensity unparalleled in larger countries (Adrianto and Matsuda, 2002; Briguglio, 2010). In particular it has been shown that shocks from disasters on small economies of developing countries increases indebtedness as well as the ability to meet the debt payment (Mora, 2009). Furthermore it has been found that when small economies are compared to developed countries’ economies, continuous impacts from disasters, significantly widen the gap in the growth of these economies with time, with noticeable negative growth for SIDS compared with developed states (Mora, 2009). Particularly fixed capital formation is affected. Fixed capital are physical assets such as educational and health institutions. For example, in 2004, Hurricane Ivan which impacted the Caribbean SIDS Grenada, resulted in damages the equivalent of twice that country's GDP and extended the debt service payments by 20 years (OECS (Organisation of Eastern Caribbean States), 2004). In contrast to unprecedented floods in the UK in 2014 and 2017, which caused the devastation of several properties in England, according to leaders, money would be no object in the relief effort. As stated below in reference to these floods,

"Money is no object in this relief effort. Whatever money is needed, we will spend it."  
Former UK Prime Minister, David Cameron (BBC, 2014)

'With things like this, money won’t be a problem – we do have reserves we can use for this type of incident.' Leader of Cornwall Council (Rawlinson, 2017)

Like Barbados, many SIDS economies rely on tourism. In 2007, international tourism receipts accounted for 51% of the total value of exports in SIDS in comparison with less than 10% in other developing countries (OHRLLS/UNISDR, 2013; UNISDR, 2013). The UNISDR (2013) makes the point that the dependency of SIDS on tourism as the mainstay of SIDS economies is also an economic risk because of the assets that are accumulated and investments being made in areas with high levels of disaster risk (beachfronts and coastal locations). Sea level
rise (SLR) threatens to inundate 49-60% of tourist properties in the Caribbean SIDS (Scott et al., 2012). Overall, loss of beaches for Caribbean SIDS with coastal tourism destinations will alter their competitive position and sustainability, and will also have implications at the property level, local level and national economy level (Scott et al., 2012). In particular, it is estimated that the Caribbean will lose $446 million annually by 2080. This will be mainly incurred from business interruption by disasters related to natural hazards to the tourism sector (Mahon et al., 2013). It is notable that six of the top ten countries with the greatest proportion of tourism assets at risk to cyclone wind damage are small islands (UNISDR, 2013). Remaining competitive has therefore been linked to disaster risk management schemes in the tourism sector in SIDS (UNISDR, 2013). This can include tourism sector vulnerability assessments that inform island risk calculations as a means for economic sustainability (Kellens et al., 2012). A DRR-CCA risk governance framework must be relevant to the economic context of SIDS. It should support competitiveness of tourism and other key economic sector drivers.

2.3.2. ISLANDNESS

Having reviewed the concept of smallness, the other term islandness, may also have implications for DRR-CCA. Islandness has been defined in terms of exposure to natural hazards (Connell, 2013) and touching back on the smallness concept, small size of the SIDS means that the individual hazard events like cyclones may affect the whole territory or economy. Recently Hurricane Irma vividly demonstrated the catastrophic destruction that disasters can have on entire SIDS populations (BBC, 2017). Nonetheless, there have been attempts to rank SIDS as more or less exposed to natural hazards. Sao Tome, Vanuatu, Tonga and Kiribati have been ranked as highly exposed whilst Barbados has received a medium ranking (Easter, 1999; Turvey, 2007). Barbados however stands out as the SIDS with the highest risk to pluvial flooding (as mentioned in Chapter 1). Other SIDS like Antigua and Barbuda may lose up to 80% of its fixed capital to earthquakes and cyclonic winds (UNISDR, 2013). Only recently ‘Irma’ a category 5 Hurricane resulted in extensive destruction on the island of Barbuda, making the entire island uninhabitable- and as a result it has been entirely evacuated (BBC, 2017). Regardless of these rankings as mentioned, the smallness factor means that, the impacts on one SIDS or the other from hazards could be highly devastating.

Another perspective to understanding islandness is in terms of limited natural resources, remoteness, and geographic fragmentation (especially in the Pacific). Islandness is also
associated with large coastal zone but fragile environments, and a high interdependence on the services provided by their environment systems for survival and their livelihoods (McCall, 1994; Pelling and Uitto, 2001; Nurse and Moore, 2007; Christensen and Mertz, 2010). This high interdependence puts a strain on the environment and has immense ripple effects on livelihoods and other social and economic vulnerabilities (Nurse et al., 2014). Having an extensive coastal zone compared to land, also means that coastal areas sometimes are the only place for development to take place (McCall, 1994). Often these are the most fragile areas. Socio-ecological systems are further stressed from exploitation, pollution, human encroachment and disease that can harm biodiversity (Kingsford et al., 2009; Caujapé- Castells et al., 2010). In some cases there may be circumvention of environmental protection policies to address livelihoods of ordinary people or to generate much needed or anticipated revenue from coastal development (Nunn, 2004). Other stresses can include habitat loss and degradation; and invasive species driven by other sources (Sax and Gaines, 2008). These stresses together with climate-induced stresses (from climate change and disasters) increase vulnerability and make it difficult for socio-ecological systems to bounce back after shocks. As introduced in section 2.2, an understanding of vulnerability in the context of islands requires that all of these dimensions of vulnerability are assessed (Rasmussen et al., 2011; Birkmann et al., 2013). As will be discussed in section 2.7 much has not been done on how socio-ecological systems could be considered as part of a governance approach to integrating DRR and CCA.

Besides the interdependences amongst and within socio-environmental systems, remoteness and insularity predisposes them to challenges with high communication, transport and energy costs, and irregular international transport volumes (Hein, 2004; Connell, 2013). This has a negative impact on the economic growth of small states (Armstrong and Read, 2002), and as mentioned earlier, leaves limited funding for DRR and CCA. Issues concerning geographic fragmentation include challenges with governing across multi-island states. Several issues have been identified with governance over these extended territories for example in the Pacific (section 2.7.2).

2.3.3. BENEFITS OF SMALLNESS AND ISLANDNESS

Thus far a number of complexities related to smallness and islandness that need to be considered for DRR-CCA have been discussed. These include constrained development options, limited human and financial resources that are further dampened by high per capita
costs for administration. There is also a highly fragile but critically important coastal zone that must be centralised in the DRR-CCA approach; as well as highly interconnected socio-ecological systems that are essential to SIDS economies and livelihoods. The smallness, high specialisation of the economies in SIDS and exposure to natural hazards and shocks may suggest that the DRR-CCA decision-making framework should engage with economic stakeholders to be relevant. While many of these, smallness and islandness, features seem to limit the DRR-CCA approach that could be applied, they may however offer some benefits for DRR-CCA.

Blancard and Hoarau (2013) argue that smallness is not necessarily a disadvantage given the power of agency at the local and national level that can be assembled because of small size, and which can offset a number of smallness vulnerabilities. This is in view of the significant development achievements by many SIDS in terms of health and education for example. It is suggested that small size has promoted social cohesion that has enabled necessary policies to be established; and the transfer of these essential ‘public goods’ to the benefit of citizens (Blancard and Hoarau, 2013). Notwithstanding as also recognised by these authors and others (Kaly et al., 2002; Blancard and Hoarau, 2013), the disproportionate effects from climate change (as discussed at section 1), on strained coastal resources, water supply and ecosystems will more likely than not exacerbate their economic vulnerability. This however does not preclude the potential for cohesion and power of agency in a small context to act as a prospect towards mobilising an integrated DRR-CCA approach. There is also some emerging research that seems to suggest that smallness offers resilience, adaptive capacity and enhanced social capital (Adger et al., 2004; Cinner et al., 2012; Nurse et al., 2014). Each of these could offer some advantages for SIDS DRR-CCA risk decision-making processes.

The discussion of benefits related to SIDS resilience is mainly with respect to their islandness features. SIDS’ experience with extreme events (Barnett, 2001), familiarity with their environment and understanding of what is needed to adapt contributes to their resilience (Tompkins et al., 2009; Le Masson and Kelman, 2011). This kind of SIDS resilience could enhance the knowledge base for a DRR-CCA integrated decision-making framework. Concerning adaptive capacity, smallness arguably may increase adaptive capacity. In a study (Cinner et al., 2012) that compared adaptive capacity in small island coastal communities (e.g. Seychelles and Mauritius) to larger countries, SIDS communities were found to make changes that resulted in comparatively high adaptive capacity. Examples include their ability to expect change and formulate strategies; mindfulness of human impact on the environment;
social capital; readiness to change occupation; diversity of livelihoods; physical assets; access to technology and infrastructure (Cinner et al., 2012). There also seems to be a belief in their own capacity that supports the presence of adaptive capacity (Adger and Brown, 2009; Kuruppu and Liverman, 2011). Increased adaptive capacity in the SIDS context could help to generate a DRR-CCA decision-making approach that is highly responsive to their needs. With respect to heightened social capital, it offers dense networks, collective action and norms of reciprocity (Petzold and Ratter, 2015). Examples of this have been found in some Caribbean SIDS contexts where strategic and local networks and interactions have been used to find strategies to manage risks from present climate extremes (Adger, 2003). Heightened social capital is highly beneficial for communication aspects of an integrated DRR-CCA risk governance framework. It is conducive to the collective handling of risk, and supports how decision-making power is assigned (Klinke and Renn, 2012). Findings on the benefits of islandness and smallness are still limited as such, there has not been sufficient research to generalise findings to SIDS as a whole (Nurse et al., 2014). Nevertheless there is consensus that what is needed is a bolstering of the potential observed (Nurse et al., 2014) recognising that even with this potential, SIDS remain vulnerable to long term future climate change (Parks and Roberts, 2006).

The smallness and islandness features discussed offer potential, challenges and complexities that need to be accounted for in DRR-CCA integrated frameworks for risk governance. In the following section, the terms governance and risk governance are reviewed and how they are applied in this thesis for DRR-CCA. Risk governance is the concept being applied to conceptualise and identify prospects for DRR-CCA in practice. It is based on the term governance.

2.4. GOVERNANCE

Governance has been argued as playing an integral role in successfully integrating CCA and DRR (Barnett and Adger, 2003; Djalante, 2013). Governance has been defined as, the group of state and non-state actors and processes which are organised horizontally and lead to collective binding decisions without superior authority (van Asselt and Renn, 2011, Wolf, 2002). It is also described as the traditions and institutions by which authority in a country is exercised (Kaufmann, Kray and Mastruzzi, 2009). Institutions are further understood as the formal and informal rules that constrain economic, social and political behaviour. Formal rules may include laws and regulations and informal rules could include social customs,
Weak governance creates conditions that make a country susceptible to impacts from exposure to natural hazards (Gall et al., 2014). Poor countries are shown to have weak governance and institutions and this correlates highly with the concentration of high disaster risk (Tierney, 2012) which is usually demonstrated in higher death tolls (Kahn, 2005) and vulnerability to disasters (UNISDR, 2011). Furthermore, there is recognition that vulnerability to disasters overlaps with a number of deficiencies in governance. These include, corruption, lack of respect for the rule of law, weak environmental regulations, and lack of meaningful public participation in decision-making (Tierney, 2012).

There are inextricable linkages between problems associated with disaster vulnerability, governance and broader development challenges (Pelling, 2003; Wisner et al., 2004; Ahrens and Rudolph, 2006; Kusumasari and Alam, 2012; Tierney, 2012). To this end, countries with a higher level of institutional quality or good governance tend to have better governance of risk as well as a more open government which is supportive of disaster risk reduction (Lassa, 2010; Handmer and Dovers, 2013; UNISDR, 2015a). Key features of a governance structure that fosters development and supports risk reduction include participation, accountability, predictability and transparency (Ahrens and Rudolph, 2006). Notwithstanding, even in developed and rich countries where there is established governance, they still experience catastrophic disasters. Good governance is not necessarily an indicator of good disaster governance or disaster risk governance. The UNISDR (2017) defines disaster risk governance as:

*The system of institutions, mechanisms, policy and legal frameworks and other arrangements to guide, coordinate and oversee disaster risk reduction and related areas of policy* (UNISDR, 2017, 'disaster risk governance').

The experiences of the USA with Hurricane Katrina in 2005, and the Kobe earthquake in Japan in 1995, illustrate this point well. Some of the disaster risk governance issues that led to these tragedies included the lack of comprehensive, timely, accessible and reliable information, to all concerned stakeholders. Issues were also identified with autonomy, unaffordable disaster risk reduction measures, limited private public partnership, accountability, adaptability to local conditions and cultural contexts including unshared values, beliefs, customs, and traditions (Gopalakrishnan and Okada, 2007). In addition, the complexity in systems was not recognised, there was a lack of comprehensive and efficient approaches, a lack of equity in the distribution of hazards, limited public participation, and sustainability issues (Gopalakrishnan and Okada, 2007).
In view of the particular importance of governance to reducing risks to disasters, global frameworks such as the Hyogo Framework for Action (HFA), 2005-2015, which was the first internationally agreed framework for DRR make governance a key priority. Under priority 1 the HFA sought to ‘Ensure that disaster risk reduction is a national and local priority with a strong institutional basis for implementation’ (UNISDR, 2007). Key governance indicators under this priority emphasised that there should be policy and legal frameworks in place for DRR, decentralisation and capacity building; resources for implementation across all levels, community participation, and a multi-sectoral mechanism for coordinated DRR implementation (GOB (Government of Barbados), 2013b). Similarly, the CDEMA regional CDM Framework under priority 1 also focuses on governance—specifically institutional strengthening at all levels. According to the UNISDR’s review of progress on the HFA related to governance (UNISDR, 2015a), priority 1 has been an area where most countries have reported progress with putting legislation, policies, and multi-sector platforms in place. Nevertheless there has been limited success in applying regulations, standards, policies and norms, for DRR across development sectors (UNISDR, 2015a; Wilkinson et al., 2017). Regional reports from the Caribbean also validate this finding (CDEMA, 2014). Specific country assessments also demonstrate that though progress has been made with establishing platforms for coordination and cooperation, there are still specific gaps in this area as well.

For example in St. Kitts and Nevis there is no formal platform and in Barbados there is limited capacity to systematically deliver the technical input required (GOB (Government of Barbados), 2013b; Wilkinson et al., 2017). Beyond SIDS contexts alone, the lack of capacity to develop and sustain disaster governance capabilities in the face of several other pressing issues such as poverty also contributes to lack of resources to support comprehensive disaster governance (Tierney, 2012). There are also challenges with broadening the membership of the coordinating platforms beyond disaster managers to include more development actors (Wilkinson et al., 2017). The community approach is also in need of reform to extend beyond response to address DRR. Limited finances, weak inter-ministerial consultation, and the need for policies to be updated to reflect DRR are still challenges (GOB (Government of Barbados), 2013b). These challenges, together with others such as disparities in political empowerment are broader global challenges that will need to be addressed for progress to be seen in DRR (Tierney, 2012). These findings reflect the fact that disaster risk governance is still an emerging topic where progress has been largely conceptual (Gall et al., 2014). So far, research emphasises that where arrangements are not risk based or comprehensive; but rather reactive and fragmented—existing at different scales and focusing on specific phases of the disaster cycle, disaster risk governance is challenged (Tierney, 2012). Related to the challenge of the reactive approach, is that disaster risk governance is mainly seen as the responsibility of the disaster manager and rarely a part of
day-to-day activities of public or private activities such as planning, social welfare, investments or fiscal responsibilities (Gall et al., 2014).

There are nonetheless positive examples of progress with DRR mainstreaming from the Pacific SIDS, e.g. Togo, where climate change debates and environmental issues appear to have catalysed changes in DRR legislation (Wilkinson et al., 2017). In Caribbean SIDS like St. Kitts and Nevis, DRR has been incorporated in poverty alleviation plans (Wilkinson et al., 2017). The outlook for risk governance now seems to call for pragmatic approaches that are catalytic, financially effective and complementary to other development agendas (Wilkinson et al., 2017). Strategies for DRR will require long-term strategies to achieve the desired institutional adjustments for DRR that are appropriately funded. An integrated DRR-CCA approach is well suited to advancing these goals.

Governance shapes the context for DRR but how disaster risk is governed is particularly important. The development ranking of the SIDS cannot be used as the benchmark alone for how risk will be managed. The global context also informs the national governance context by way of social, economic, and political influences of the world system, including globalization. This wider global context also influences disaster governance from the perspective of globalisation and its tendency to create interdependencies and thus create systemic risks. These risks should be considered in a comprehensive analysis of risk governance (Goldin and Vogel, 2010). The role of international agencies such as the UN and IDB particularly in developing countries in shaping national agenda also becomes important. In the context of Barbados, all three levels would be relevant to a national DRR-CCA governance system. This research however focuses mainly on how DRR-CCA could occur at the national level in day-to-day practice for risk decision making. This thesis applies the concept of governance from the perspective of how it affects the actual risk decision-making process. This has been described as risk governance.

2.4.1. DRR AND CCA INTEGRATION IN THE WIDER GOVERNANCE DISCOURSE

Before further developing the concept of risk governance it is essential to contextualise this research within the wider political science literature on governance. In this regard, the issue of integrating DRR and CCA fits within a broader discussion of policy coherence in environmental governance. As will be shown in section 2.7 by maximising the commonalities and addressing overlaps in DRR and CCA through coherent planning, efficiency in policy implementation can be achieved and should be pursued. Policy coherence is a growing
concern in environmental governance because it addresses inefficiency in implementation. Inefficiency in implementation can lead to unproductive rather than effective strategies to reduce risks associated with disasters and climate change - which from a climate change perspective could also lead to mal-adaptation (Scobie, 2016). As DRR pursues integration into mainline development sectors, and CCA follows in suit, these approaches will call for new actors to be involved and new mechanisms to tackle environmental problems and could result in policy incoherence and associated absorptive capacity. Section 2.4 introduced the importance of accountability and transparency in governance, policy coherence is also a key pillar of good governance (Scobie, 2016). Similar to the disaster governance discourse, poor coordination, and weak institutions are key problems of policy coherence which are putting a focus on frameworks that address resources, political will and accountability (Scobie, 2016).

The environmental governance discourse is also seeking to tackle issues with how to better govern the earth system in the face of a changing climate. Frameworks emanating from this discourse therefore provide a critical basis for the framework to be applied that not only address disaster related risk but also climate change. Environmental governance (Lemos and Agrawal, 2006) is useful for the purposes of this research because it emphasises the importance of engagement across institutions, sectors and scales. This is later discussed in section 2.71 under the caption of multi-level governance and polycentricity, which are further grounded in research related to collective action (Ostrom, 2014). Other environmental governance concepts related to participation and inclusiveness are also used in this thesis to conceptualise the DRR-CCA risk governance framework for SIDS, as a result of building on prior DRR-CCA integration frameworks that draw on these concepts. For example the Adaptive Integrated Disaster Resilience (AIDR) Framework in section 2.7.1 by Djalante et al., (2013).

Given the governance challenges related to the lack of cooperation and also because of the interdependencies of systems affected by climate change and for which disruptions can cause disasters, the environmental governance concepts on inclusion, involvement, participation, co-creation of knowledge and collaboration are essential to addressing the problem of integration. Paper 1, section 4.5.1 discusses this further. As will be shown these ideas also filter into other concepts such as joined-up and network governance that further develop the notion of partnership creation, and collaboration (see Chapter 4). Environmental governance also offers this thesis insight into the kinds of relationships that need to be considered for managing systems for DRR and CCA (Chapter 4). The thesis incorporates a framework that
has adapted the environmental governance framework on partnerships for DRR-CCA (Forino et al., 2015). This is further discussed in section 2.7 and applied in Chapter 4.

Connected with the environmental governance approach is the earth systems governance concept (Biermann, 2007) which as will be discussed at section 2.7, applies the concept of governance to adapting to environmental changes. Earth System Governance draws on the concepts of environmental governance by incorporating inclusiveness, architecture and agency, and basic governance themes on accountability. This framework has been successfully applied to investigate challenges related DRR-CCA integration (Gero et al., 2010; Djalante, 2013) that looks at five potential problems to governance related to 1) architectures (principles, institutions, decision sharing practices 2) agency (what other actors besides the state are involved 3) adaptiveness (what are the abilities to adapt and transform) 4) accountability and legitimacy, and 5) modes of allocation of fair and equitable resources. The Earth Systems governance concept adds to the environmental governance concept, key framings on adaptiveness related to innovation, learning and flexibility. While the earth systems governance framework sets out a useful way for problematizing DRR-CCA, it does not connect the risk governance stages of early detection, hazard assessment, risk assessment, risk characterisation and risk management with the governance process, and for this reason an alternative framework is used to formulate the SIDS framework that also integrates the environmental and adaptive governance core principles discussed so far (See Chapter 4). Adaptiveness and adaptive governance approaches to addressing uncertainties and changing baselines associated with climate change are essential to an integrated risk governance framework for SIDS (see section 4.5). As will be discussed in the preceding section 2.7 an adaptive governance approach (Folke et al., 2005) incorporates these features and has been widely integrated in the risk governance frameworks identified to formulate the SIDS framework. Specifically section 2.5 and 2.7 introduce the two main frameworks upon which the SIDS risk governance framework is based- an adaptive risk governance framework that incorporates feedback loops, systems thinking, deliberative processes and early detection stages (Renn and Klinke, 2013); and Djalante’s (2013) AIDR overarching framework for DRR-CCA, which also incorporates concepts of learning, innovation and self-organisation (discussed at section 2.7). The next section reviews how these concepts are conceptualised as part of the risk governance approach to addressing DRR and CCA integration.
2.5. RISK GOVERNANCE

It has been suggested that disaster risk governance fits within risk governance since in practice, risk governance covers other risks such as nuclear risks and pandemics that do not now come under DRR or CCA (Tierney, 2012; Gall et al., 2014). Notwithstanding, since disaster governance also addresses governance in the other disaster management phases of response, and recovery and whereas risk governance only seems to focus on risk reduction and preparedness, in this thesis it is considered as an element of disaster governance. See Figure 2-4. In the following sections risk governance is introduced, the potential challenges and indicators of good risk governance.

![Figure 2-4: Risk Governance Within the Broader Governance Context of Development](image)

2.5.1. RISK GOVERNANCE OVERVIEW

Risk governance may be defined as,

*The totality of actors, rules, conventions, processes and mechanisms concerned with how relevant risk information is collected, analysed and communicated and how management decisions are taken. Encompassing the combined risk-relevant decisions and actions of both governmental and private actors, risk governance is of particular importance in (but not restricted to) situations where there is no single authority to take a binding risk management decision, but where, instead, the nature of risk requires cooperation and coordination between a range of different stakeholders. Risk governance, however not only*
includes a multi-faceted, multi-actor risk process, but also calls for the consideration of contextual factors, such as institutional arrangements (e.g. the regulatory and legal framework that determines the relationship, roles and responsibilities of the actors and coordination mechanisms such as markets, incentives and self-imposed norms) and political culture, including different perceptions of risk. (Renn, 2008 p. 374)

It includes the institutions, organisations, laws, regulations and contributions from civil society and private sector actors that influence risk management (Brunner et al., 2005; Holley et al., 2011).

Risk governance is conceptually related to environmental governance (Lemos and Agrawal, 2006), earth system governance (Biermann, 2007), and collaborative governance (Holley et al., 2013; Baird et al., 2016) (Tierney, 2012) it shares commonalities with respect to its focus on institutions, stakeholders, multi-level governance and how they work together to establish binding decisions but related specifically to decisions about how risk is managed. It is still an emerging area of research. Recently the concept has been enhanced to address climate change with the introduction of the Adaptive Risk Governance (ARG) framework (Klinke and Renn, 2012). Adaptive governance as has been mentioned in the preceding section 2.4.1 is characterised by governance concepts that are more innovative, and flexible than ‘pure’ governance, and also fosters learning to better manage uncertainties and complexities in the system (Dietz et al., 2003; Brunner et al., 2005; Folke et al., 2005). Its concepts may be found in the work of collaborative governance (Holley et al., 2013), cooperative management (Olsson et al., 2004) and adaptive management (Lee and Smith, 2010). Adaptive governance combined with collective actions could provide a framework to address the complexities of environmental problems such as those that require CCA-DRR approaches (Lebel et al., 2010). See section 2.7.1 for further details. The adaptive risk governance framework used in this thesis applies these adaptive elements to risk governance. The thesis uses this framework that maintains conventionally accepted elements for risk analysis (assessment, management, communication) (Renn, 2008). It also provides a conceptual and model framework for understanding, managing and organising the various ways in which the many actors, individuals, and institutions, public and private collect, analyse, communicate, and decide to regulate risks particularly those surrounded by uncertainty and complexity in that it cannot be calculated as a function of probability effect (Klinke and Renn, 2012). See Figure 2-5. This is discussed in detail in Paper 1 (Chapter 4). Comparative to the other frameworks discussed at section 2.4.1 it allows for key principles of governance to be investigated related to multi-level governance, institutions, resources and adapativeness however what it add is a specific
concept for tracing the risk management stages through within the context of governance—see paper 1.

Given the diversity of political and regulatory cultures there is no common global approach to risk governance (Renn, 2008). So far, it has not been applied within the context of SIDS as a means for advancing DRR-CCA. This thesis seeks to investigate the challenges, potential and prospects for doing so. Research on challenges and indicators of good risk governance can provide a starting point for how to advance with using risk governance as a means for DRR-CCA.

![Adaptive and Integrative Risk Governance Model](image-url)

**FIGURE 2-5: ADAPTIVE AND INTEGRATIVE RISK GOVERNANCE MODEL, SOURCE: KLINKE AND RENN, 2012 P.279.**

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### 2.5.2. POTENTIAL CHALLENGES AND INDICATORS OF GOOD RISK GOVERNANCE

Risk governance sets up a framework for how risk information can be generated, evaluated and used in decision making for action. Cedergren and Tehler, (2014) suggest that there may be challenges to executing risk governance from three levels: 1) purpose level- why the risk governance system should exist; 2) functional level- issues with what it should do; and 3)
form level issues related to how it should function (Boholm et al., 2012; Cedergren and Tehler, 2014). This is a design perspective (Brehmer, 2007). Issues can also be related to the supporting context that is the organisational and institutional capacity, as well as the regulatory, political, social context and risk culture. The organisational and institutional capacity is the capability of the various risk actors to fulfil their risk governance roles (Renn, 2008). Renn (2008) suggests key capacity performance indicators related to assets, skills, and capability that could be used as benchmarks (Renn, 2008). See Figure 2-6. It has been suggested that some Caribbean SIDS have limited technical expertise/ capacity in the use of risk decision making methodologies which has been described as ‘fragmented’ and ‘variable’. Expertise for governing risk is not institutionalized across the Caribbean but is rather limited to external consultants, NGOs or research organisations (Acclimate, 2013). These indicators are therefore highlighted given the resource constraints of the SIDS. This therefore has implications for how an integrated DRR-CCA risk governance approach can be addressed.

In view of these possible avenues for challenges to the risk governance approach, it would seem that there are already signals of capacity and risk culture hindrances in SIDS. As mentioned in section 1.5, notwithstanding the arguments for DRR and CCA as investments, the required shift to anticipate risks in public and private investment remains a challenge for most governments as response is still the priority (UNISDR, 2013). This is a challenge related to the risk culture. Besides this, related to knowledge/ expertise limited investment such as challenges in understanding the complexity of the interactions to be considered between the economy and natural disasters (Pielke and Pielke, 1997; Changnon et al., 2000) have been
cited as possible reasons for not investing in risk reduction. Overall, capacity issues are some of the main reasons given for not making the shift to reduce risk e.g. limited state capacity (Ismail-Zadeh and Takeuchi, 2007). Other examples include incapacity of scientists to provide decision makers with the tools to generate awareness and provide convincing proof that can help them to establish public policies, and incorporate risk management in public–private investments and planning (Mora, 2009). Another is the need for more solid arguments and approaches that allow for comparisons with other areas of government expenditure (McBean, 2004)- for example, tourism which is a driver of many SIDS economies. Poor inclusion of the scientific community (Ismail-Zadeh and Takeuchi, 2007) is also another issue. The last three issues relate to how information is made, packaged and shared. Finally power holding has been cited as a possible reason because it is easier to maintain power by retaining resources to buy loyalty as opposed to protecting citizens from disasters particularly in small coalition systems (Flores and Smith, 2010). This relates to the political, social and risk culture. I now examine further hindrances that could be considered when identifying the prospects for DRR-CCA risk governance. These are related to information, institutions and deliberative processes; that fall within a larger scope of potential challenges to risk governance.

The availability of information is essential for an effective risk governance framework. Information could be from a number of sources, including individual expertise, external stakeholders, informal communication, external consultants, specialist advisors and reports (Mauelshagen et al., 2014). When information is inaccessible it affects understanding, planning for, managing and monitoring adaptation (Moser and Ekstrom, 2010). Additionally, improving the usability of the information has been identified as a major way to improve the uptake of climate change and risk information in decision making processes (Morss et al., 2011; Kirchhoff et al., 2013). Though information on climate change and climate variability has rapidly evolved and grown, the use of the information in decision making has been below expectation (Morss et al., 2011; Kirchhoff et al., 2013). Suggestions to improve usability include the use of participatory processes, more producer- user interactions, and boundary organisations (Kirchhoff et al., 2013).

Also ensuring that information is credible (Kirchhoff et al., 2013) is another issue that must be addressed. It is linked with ensuring the quality, accuracy of the information, and that it is from reputable sources (Kirchhoff et al., 2013). Other features such as saliency and legitimacy are important and are related to some degree to the timeliness, and comprehensiveness of
the information provided-as it also includes meeting temporal, spatial scales, and context specific demands of decision makers (Kirchhoff et al., 2013; Spiekermann et al., 2015). The legitimacy of the information can also be a challenge to its use. It includes, openness, and transparency in the production and dissemination of the information (Kirchhoff et al., 2013; Spiekermann et al., 2015). The availability of funding and capacity are also essential determinants—capacity in the form of time, skills, access to boundary organisations (Mauelshagen et al., 2014). Particularly for spatial information (discussed at section 2.7), policy guidance is essential (Mansourian et al., 2006; Joshi et al., 2010; Ran and Nedovic-Budic, 2016). Lack of formal sharing mechanisms has been identified as a key determinant of use of information (Mauelshagen et al., 2014; Papathoma-Köhle et al., 2016). The ability to adapt science depends on individual experience, values, networks, organization capacity and institutional arrangements- policy among others (Lemos and Tompkins, 2008). All of these operate in a risk governance framework.

As mentioned in the previous section (2.5.1), risk governance is understood to sit within the wider field of disaster governance. It is therefore expected that where there may be challenges with disaster and adaptation governance and also wider governance arrangements that this would also affect risk governance. For example, budgetary allocations are essential for ensuring that requisite financial resources are available for risk governance where there are shortfalls in resources for disaster governance it can affect how the risk governance process should function. Strong budgetary allocations for disaster management are however usually transient- strengthening at times of crisis and marginal before and after the crisis. Inadequate budgetary arrangements for risk reduction are linked to inadequate financing of disaster management sector, and weak human and institutional capacities, it could therefore also be a challenge for risk governance. The UNISDR (2013) therefore uses ‘budgetary allocation’ as an indicator of the level of investment in disaster risk reduction (UNISDR, 2013). Furthermore at the root of limited budgetary support could be limited legislation and political will to implement that legislation. Literature suggests that risk governance activities such as risk assessment and risk management should be integrated into development policies and planning at all levels of government; it should be legislated and enforced (UNISDR, 2015a). Rather than consistent support that is reflected in policy adjustments, strong political interests come to the fore in the aftermath of disasters; and in the case of climate change adaptation it may be driven by current international trends and prominence (Mercer, 2010). External financing is often sought since resourcing for risk governance may not be necessarily institutionalised or prioritised as part of SIDS development planning and they often do not have the resources or options to address climate
change and other development challenges themselves (Kelman, 2013). External funding can therefore help demonstrate and provide prospects to encourage government investment in risk governance.

Central to a risk governance approach is the bringing together of various entities—governmental and non-governmental, and private sector organisations that may engage in risk governance. The network of actors managing risks will vary depending on the risk and situation (Renn, 2008). Therefore to improve effectiveness it is helpful to understand the actor networks that could be operating in the case of climate related risks in each spatial level of governance, and for each of the risk governance processes (Renn, 2008). Furthermore, effective communication, inclusion and participatory/deliberative approaches are necessary. Paper 1 (Chapter 4) and Paper 2 (Chapter 5) section 5.4.3.2 provide further details on these features. The improper functioning of deliberative processes can however increase risk levels (Renn, 2008). It could also introduce unnecessary bureaucracy, cause more inequality, may result in unsustainable practice and may be costly to society to implement risk reduction (Renn, 2015). Nevertheless there is ample evidence that deliberation can be effective in improving risk governance performance (Rowe et al., 2004; Renn, 2008; Mannarini and Talò, 2013; Scolobig and Pelling, 2016). It is therefore important to identify, understand, weigh, and balance the costs of accomplishing risk reduction with the goal of risk reduction (Renn, 2015). Furthermore it is notable that participants in the deliberative approach do not all need to be involved at the same time (Renn, 2015). As such, junctures of involvement should be identified in view of the resources that could be available in the context of SIDS innovation is necessary to ensure that the process is efficient and effective. Participation in the risk governance process will be affected by the governance and institutional context (Lassa, 2010). Research shows that country contexts determine the uptake of risk governance approaches (Rothstein et al., 2013), the implications of the SIDS context needs to be investigated. Certainly, the country context determines the regulatory, political, social context and risk culture. These have already been identified to play a vital part in the success of the risk governance approach (Renn, 2008). The SIDS context may be influencing risk governance challenges and potential for DRR-CCA. This is discussed in Paper 3 (Chapter 6).
2.6. GOVERNANCE IN BARBADOS

In this section the background on some of the dimensions of governance in Barbados are reviewed, as this frames risk governance and informs how the findings on why challenges to risk governance exist as well as the prospects for an integrated approach.

2.6.1. OVERVIEW OF GOVERNANCE

Since November 30, 1966, Barbados has been a sovereign nation and has also enjoyed stable governance. Prior to independence Barbados had been a British colony for more than 300 years. The influence of this extensive period of colonialism is evident in the governmental structures in Barbados, and education system. As such, a Westminster system of governance prevails. The British monarch is the head of state and is locally represented by a Governor-General. An elected Prime Minister, a Cabinet, a House of Assembly, and a nominated Senate govern the country. Barbados is a democratic society, which vacillates between 2 political parties. The Democratic Labour Party is now running the government of the country. Barbados is governed by a central government system. There is no local governance arrangement in place either at the parish, constituency or district level. All local planning and development decisions are taken at the national level. The government has recently embarked upon community constituency councils however; these are still in a fledgling state and presently focus on social activities. In the absence of a local government tier in Barbados, elected MPs play a critical role between the community and the state (Pelling, 2003).

The number of non-governmental organisations operating in Barbados is not registered however there are a number of community based and civil society organisations (Commonwealth Nexus Partnerships, 2017). Community based organisations are mainly sports based (Pelling, 2003) and civil society organisations mainly address environmental heritage and conservation, health, agriculture, and culture (Commonwealth Nexus Partnerships, 2017). Pelling (2003) indicates that the biggest gap in civil society is the lack of developmentally oriented organisations in Barbados and the reluctance of young people to join local organisations. The umbrella civil society entity is the Barbados Association of Non-Governmental Organisations (BANGO) which facilitates civil society engagement in national and international matters (Commonwealth Nexus Partnerships, 2017). Other members of civil society include two main trade unions in Barbados- the National Union of Public Workers and the Barbados Workers’ Union (Commonwealth Nexus Partnerships, 2017). There is also an overarching Congress of Trade Unions and Staff Associations of Barbados.
(CTUSAB) (Commonwealth Nexus Partnerships, 2017). With respect to key civil society organisations that have a more direct role to play in disaster risk reduction and climate change adaptation decision making, there is a National Red Cross Society (disaster risk reduction), and the Future Centre Trust Barbados which focuses on environmental issues. Other entities such as the district emergency organisations (DEOs) operate at the community level but are coordinated by the government for disaster management (GOB (Government of Barbados), 2017). There are 30 DEOs, which were established by the government of Barbados through the DEM (then called Central Emergency Relief Organisation or CERO) in the late 1970s in accordance with the electoral districts. The DEOS are community run organisations which act as local points of contacts for residents in times of response to disasters. They have a small pool of skill sets which include first aid (GOB (Government of Barbados), 2017). There is heavy reliance on central administration of the DEM to assist in resourcing, training and supporting activities of the DEOs. Community engagement for risk reduction is low in Barbados (Pelling, 2003). This lack of community participation is one of the greatest hindrances to disaster risk reduction. According to the study it is hindered by lack of awareness about hazards, lack of community groups, lack of community feeling and low involvement in community led disaster preparedness (Pelling, 2003). Presently there is a focus on revitalising the volunteer spirit in Barbados in disaster management (DEM (Department of Emergency Management), 2014). This thesis will elucidate the role of the main risk governance organisations and the points of connection.

Barbados boasts high scores for governance according to World bank indicators of Voice and Accountability, Political Stability and Absence of Violence, Government Effectiveness, Regulatory Quality, Rule of Law, Control of Corruption (World Bank, 2012). There has been a smooth transition of the administration of the Government over the years. The country is also known for a general degree of social stability. However there is presently a strain given recent austerity measures by the government that include increased taxation and reduction of the size of the public sector (Beckles, 2017). The country also ranks moderately with respect to transparency (scoring 61% compared to the world average of 43%) on the Transparency International Corruption Perception Index which measures the perceived levels of public sector corruption worldwide (Transparency International, 2017). In 2016 Barbados was sixth to Canada which has the highest score, in the Americas, and it is 31st globally out of 176 countries (Transparency International, 2017).
Notwithstanding overall governance successes, from an environmental perspective Barbados has had issues with poor planning (land-use) and sanitation, particularly illegal dumping in gullies. Gullies have a natural role in managing flood waters (Stantec Consulting Caribbean Ltd., 2003; Simpson et al., 2012) and when compromised result in significant damage to property and loss of life. For example in the case of the floods of 1986, many homes were flooded and several swept out to sea on the west coast due to the passage of torrential flood waters from gullies (Kambesis and Machel, 2013). Furthermore, Barbados has made significant progress (1999-2008) with managing its risk. This is with respect to its organizational development, capacity and institutional actions taken to reduce vulnerability and losses. Barbados has also made progress with emergency preparations that would facilitate efficient recovery from disasters. Notwithstanding, with respect to the effectiveness of its risk management policies, its performance was deemed incipient by the IDB because its risk is still high (Cardona, 2008). It was found that there was a need to improve the capacity to anticipate, to cope and recover (Cardona, 2008). Both government and private sector have a role a play. A great amount of its risk is in exposure of its assets to climate related hazards (section 1.2). Government accounts for the greater value in assets (buildings) exposed to natural hazards when compared to the private sector (IDB, 2010), though the private sector owns most of the tourism sector assets and the economy is tied to tourism, damages to these assets will affect the government.

While Barbados’ emergency response framework is described by some as being well established (Chmutina and Bosher, 2014) and there are risk mitigation and adaptation interventions afoot, mitigation measures are limited (see section 1.2). There are also a number of gaps that need critical attention. Based on a 2013 national workshop on risk mitigation (DEM), 2013), participants suggested that there was a need to strengthen the hazard and risk information base. Furthermore, existing national structures and institutions needed to be strengthened and maximised to have the requisite policies, mandates, and budgets to manage the various threats. Additionally there was ambiguity concerning the roles and responsibilities needed for mitigating risk. There were also concerns over enforcement of critical building standard laws (that were not published, enforced and then monitored) and inconsistent EIA processes (that could be overturned by the Minister). The enforcement of the building code has however also been identified in a few studies as one of the most beneficial ways for Barbados to reduce its risk to climate change and climate related threats (CCRIF, 2010; Chmutina and Bosher, 2014). Collaboration and coordination were also highlighted for improvement that included the ineffective mobilisation and sharing of
resources (amongst government, community and the private sector), duplication and minimum outputs from risk management interventions. Specific political, budgetary and technical adjustments were therefore suggested. These included having a political champion for risk management; establishment of a network of technical professionals for risk assessments; and a policy and mechanism that links plans and budgets for risk reduction. The latter recommendation corresponds with already identified pathways for mainstreaming sustainable development in SIDS (Lal, 2011). The thesis will identify if there have been changes in the risk governance baseline in Barbados.

Research shows that the adaptive potential of Barbados is limited by a poorly functioning civil society for development and disaster risk reduction (Pelling, 2003). Participation in civil society organisations has declined, and there has been a degradation of social capital and erosion of social ties which has fostered individualism (Pelling, 2003). Some suggest that a shift to individualism has resulted from Barbados’ successful macro-economic development (Pelling, 2003). Except for large development projects that may require EIAs and public engagement, there are limited mechanisms that facilitate engagement of social actors in the risk governance process. High participation from private sector and community based organisations is cited as key components of the disaster risk reduction programme (GOB (Government of Barbados), 2013b). NGOs such as the Red Cross have been supporting the production of vulnerability assessments in specified communities (Barbados National Red Cross Society, 2010), though it is not clear how their work connects with the national system. Other community organisations such as the DEOs are essential however; the present framework for their operation is challenged with political delimitations of the organisations. This restricts their representative engagement of the community (GOB (Government of Barbados), 2013b). It is also suffering from challenges from declining volunteerism at the national level (GOB (Government of Barbados), 2013b) and in light of this there is a current campaign to revive volunteerism (GOB (Government of Barbados), 2017). It is not clear what is shaping the decision making process in Barbados- formal institution or informal institutions of culture etc. The thesis asks, what are the existing DRR and CCA risk governance institutions and processes in principle and practice? How are features of integrated DRR -CCA exhibited in structures and processes for risk governance in principle and practice? What is the potential shown by interactions and interconnections across structures and processes for integrated risk governance as revealed by social network analysis? The thesis will provide information on these areas towards identifying the potential (objective 2) and challenges (objective 3) for DRR-CCA risk governance.
2.7. Integrating DRR and CCA

In Chapter 1, the basis for an integrated approach to DRR-CCA was introduced as being beneficial to SIDS. Both DRR and CCA seek to reduce vulnerability and enhance resilience (Venton and La Trobe, 2008) (Figure 2-7) hence linking can bring co-benefits (O’Brien et al., 2006; OHRLLS/UNISDR, 2013).

![Figure 2-7: Similarities and Differences of DRR and CCA. Source (Gero et al., 2011, p.312).](image)

Integration could benefit SIDS because it is logical for reducing drivers of vulnerability (UNISDR, 2013), it would promote effectiveness and efficiency (Schipper, 2009; Mercer, 2010). It also supports practicality (Mercer, 2010), strategic intervention (Venton and La Trobe, 2008) and holistic development (Mercer, 2010; CDEMA, 2011). These are discussed below:

1. Climate change amplifies underlying drivers of risk. Unless a DRR approach of addressing these drivers is applied, in the coming decades, increased intensity and frequency of climate-related disasters will dramatically increase physical and economic losses. This will result in stalled or reversed, gains in reducing mortality and achieving sustainable development (Venton and La Trobe, 2008; Mercer, 2010; UNISDR, 2013). Extending from this argument is the urgency for action in Small States to minimize losses, since they are expected to experience extensive losses and damages from climate change and are already experiencing significant losses to
current climate and variability. DRR presents a logical process for tackling this problem (UNISDR, 2013).

2. The close links between CCA and DRR require an integrated approach to yield co-benefits (O’Brien et al., 2006; OHRLLS/UNISDR, 2013).

3. To avoid duplication of limited resource- financial, human and natural resources as well as increase effectiveness and sustainability (Schipper, 2009; Mercer, 2010). Examples from the Pacific where integration of CCA and DRR is evolving, demonstrate the need for better communication and coordination to facilitate holistic approaches which do not duplicate efforts or minimize success in the community (Gero et al., 2010). Furthermore Mercer (2010) and Schipper (2009) argue that an integrated approach would avoid a possible waste of resources in reinvention of the wheel of risk reduction by pursuing a separate climate change adaptation agenda. Others suggest that there are already tried and tested DRR knowledge, tools and approaches to address direct and underlying causes of hazard vulnerability applicable to adapting to climate change (IPCC, 2013; UNISDR, 2013). It would appear more effective, financially and otherwise to integrate CCA within existing DRR tools. This is particularly attractive therefore in a SIDS context.

4. Integrated approached can help reduce climate related losses through the use of widespread DRR measures which can provide an entry point for CCA through community disaster risk reduction, which connects policy with practice. This is beneficial given the top down policy driven framework for climate change adaptation which is mostly disconnected from communities, and noting that DRR has already developed community tools and methodologies that build on community experience (Mercer, 2010). SIDS may have some advantages here since there is a closer connection to communities given their small ‘physical size’.

5. Integration promotes holistic community development interventions (Mercer, 2010; CDEMA, 2011). Differences in terminology mean nothing to SIDS communities who do not see the impacts of climate change or disasters of natural origin from a sectoral point of view (Mercer, 2010; Shaw et al., 2010). Rather communities are concerned with interrelated processes such as political, social, environmental and economic factors affecting their communities. This supports the age long call in the international development community for holistic approaches (UNDP, 2004; Grist, 2008). All disasters, climate related or not hinder development and it is the root
causes contributing to them, which need to be adequately addressed. It is imperative to focus on all the underlying vulnerability factors as opposed to just the hazard per se or just climate change - this would be detrimental to the community (Mercer, 2010).

6. The scope and nature of disaster and climate-related risks are too broad and far reaching for any one/ or single agency to address, as such, an integrated CCA-DRR strategic plan is necessary (Venton and La Trobe, 2008).

2.7.1. FRAMEWORKS FOR INTEGRATING DRR AND CCA

Frameworks have been conceptualised for DRR-CCA that could be useful towards understanding and identifying the prospects for DRR-CCA risk governance. Adaptive governance (Lebel et al., 2010) (introduced at section 2.4.1 and 2.51), education (Bonifacio et al., 2010) and technology (including teleprocessing) (Dhar Chakrabarti, 2010; Joshi et al., 2010) have been highlighted as essential to the DRR-CCA approach. In addition, there are a number of common factors for DRR-CCA that include community centred engagement, social learning, flexibility, and accountability (Birkmann et al., 2010; Shaw et al., 2010; Djalante et al., 2011). Polycentricity, engagement across institutions, sectors and scales; and multiple stakeholders/ multiple disciplinary participation is also important (Dhar Chakrabarti, 2010; Lebel et al., 2010; Djalante et al., 2011). Several of the features of a DRR-CCA approach incorporate features of adaptive governance (Lebel et al., 2010) which, as introduced in section 2.5.1 could provide a framework for addressing DRR-CCA integration. Key aspects of the adaptive governance approach are innovation, flexibility and learning (Lebel et al., 2010). As mentioned polycentricity is also a key feature of the integrated approach. Polycentricity has been borrowed from studies addressing collective action problems concerning public goods, and services (Ostrom et al., 1961) and has been growing in application in the environmental governance and climate change discussions (Ostrom, 2010b, 2014). Polycentric systems are characterized by, multiple governing authorities at differing scales rather than a monocentric unit (Ostrom, 2010b, p. 552) involved in decision making that are formally independent of each other (Ostrom et al., 1961, p.831). It can refer to non-hierarchical but multiple, independent decision-makers which may have diverse structures, purposes, standards, values and interests, but cooperate, operate and learn together to realise commonly valued objectives and outcomes (Aligica and Tarko, 2012; Ostrom, 2014). Polycentricity complements the adaptive governance approach as well as enhances cooperation and the achievement of more effective, unbiased, and sustainable outcomes at multiple scales. Nevertheless it is not a panacea for solving governance problems (Ostrom,
2010b). The term can also incorporate multi-level governance (Hooghe and Marks, 2003). Multi-level governance engages corporations, nongovernmental organizations, professional societies, and advocacy groups alongside governments. It allows decision makers to adjust the scale of governance to reflect heterogeneity (Hooghe and Marks, 2003, p. 236), where those operating in multi-level governance may fit two main typologies:

- Type 1- General-purpose jurisdictions (e.g. providing all services, water, education and planning) that have fixed (durable architecture) and non-intersecting boundaries that operate at a limited number of levels e.g. supranational, national, regional (Hooghe and Marks, 2003).

- Type 2- Multi-level governance jurisdictions are not aligned on just a few levels but operate at numerous territorial scales. Jurisdictions are task-specific (a variety of different public service industries, e.g. entity for education alone that crosses community or national level scales) rather than general-purpose, and are intended to be flexible rather than durable (Hooghe and Marks, 2003).

In applying the principles of polycentricity and multi-level governance to risk governance, Klinke and Renn (2012 p. 273) suggest, this is where the, political authority for managing the risk problems is distributed to separately constituted public bodies with overlapping jurisdictions that do not match the traditional hierarchical order. Polycentricity and multi-level governance therefore may be understood as an alternative to traditional state-centred approaches with hierarchically organized governmental agencies as the main focus of power (Klinke and Renn, 2012). Based on the initial background on Barbados (2.6.2) risk governance in Barbados still seems quite state focused (type 1 multi-level governance). Similar to the benefits of the polycentric approach, multi-level governance promises more flexibility and innovation (Majone, 1998). Nevertheless they are issues with these approaches with respect to coordination across jurisdictions and different interest groups, as well as information gaps and, corruption (Lowery et al., 1995; Hooghe and Marks, 2003; Cai and Treisman, 2004). Given the benefits of the approaches, however the potential for a multi-level and polycentric risk governance approach to DRR-CCA is examined in this thesis therefore.
In addition to an adaptive governance approach, hybrid or combination [environmental] governance (Lemos and Agrawal, 2006) that heightens cooperation by involving the state-market-community divisions: co-management, public-private partnerships and social-private partnerships could be a prospect for advancing the DRR-CCA approach. The thesis builds on this combined concept of governance for the identification of the network of stakeholders and prospects for DRR-CCA governance (Forino et al., 2015). See Figure 2-8.

![Diagram of Governance Framework for CCA and DRR Integration](image)

**FIGURE 2-8: A CONCEPTUAL GOVERNANCE FRAMEWORK FOR CCA AND DRR INTEGRATION. SOURCE (FORINO ET AL., 2015. P. 381)**

DRR-CCA frameworks are limited. Thus far, frameworks focus on deepening the understanding of DRR-CCA in specific processes of risk governance. For example MOVE (Methods for the Improvement of Vulnerability Assessment in Europe) framework (Birkmann et al., 2013), is an exploratory model, that addresses vulnerability only. Similar to what has been discussed about the theoretical understanding of vulnerability in this thesis, MOVE presents a multi-dimensional vulnerability assessment approach that integrates adaptation and resilience for closer linkages between disaster risk management and climate change adaptation. It also emphasises a number of features pointed out in the earlier section.
of the thesis for consideration when integrating DRR and CCA with respect to vulnerability assessment. This includes an assessment of the organizational, institutional and political context as they shape local capacity discussed at (2.5.2). It also flags for assessment, coupled human–environmental systems (Turner et al., 2003) when dealing with the assessment of vulnerability (at section 2.2). In this regard, MOVE incorporates feedback loops, and systems thinking, to assess how the system copes and adapts (Birkmann et al., 2013). Besides MOVE, other frameworks such as the analytical (6w) framework (Lei and Wang, 2014) only suggest key questions to ask in the decision-making process when integrating DRR and CCA. Questions include, ‘what is adaptation with respect to disaster risk?’, ‘why adaptation is needed?’, ‘who adapts to what?’, ‘how to adapt?’, and ‘what are the possible principles to assess the adaptation effect? The challenge however is that these frameworks do not provide a holistic DRR-CCA risk governance framework—that addresses the issues of managing networks, and institutions for decision-making.

One framework that seems to provide a useful overarching framework for conceptualising DRR-CCA is the Adaptive and Integrated Disaster Resilience (AIDR) framework (Figure 2-9) (Djalante et al., 2013). It however does not have a risk governance focus though it encompasses all of the key DRR-CCA features that have been discussed so far in this section, that increase the adaptiveness of the system. Specifically features such as, polycentric and multi-layer institutions, participation and collaboration, learning and innovation and self-organisation and networks (Djalante et al., 2013). These are included at the outer level of the framework. Adaptiveness may be defined as, the capacity of a social actor or social–ecological system to adapt in response to, or in anticipation of, changes in the environment (Lebel et al., 2010 p.334). Some additional elements not yet discussed in this thesis, that this framework highlights is integration of DRR and CCA in all of the disaster risk management phases. Since this thesis focuses on risk governance, the emphasis however is more on the mitigation phase of disaster management rather than all phases. The AIDR framework also places community at the centre of DRR-CCA; and as discussed prior a community approach is vital. Additionally in line with the theories discussed so far that shape vulnerability and risk, governance values, aspirations, networks and capacity are included. An interesting feature of this framework is that sustainable development frames the actions on DRR-CCA. Hence, natural environment, governance, built environment, social development, education and economic development are key elements at the vertices of the inner layer of the framework. Given the impact that disasters and climate change can have on the development in SIDS this will be an essential point for the DRR-CCA risk governance framework in SIDS (discussed further in Paper 1,
Chapter 4). This takes place within the different spheres of norms, scales and knowledge (Birkmann, 2011).

Based on the AIDR seven pathways to integrated approaches to disaster risk reduction, climate change adaptation and development have been identified that will be considered within the context of SIDS. The thesis draws on these: Firstly to link agendas, and integration at the level of sectors (Djalante et al., 2013). Secondly, they call for strengthening of mechanisms such as polycentric governance architectures for DRR, provision of comprehensive disaster finance instruments, improving information management, enabling institutional learning and self-organisation and networking. See Table 2-1.
### TABLE 2-1: SEVEN PATHWAYS FOR ADAPTIVE AND INTEGRATED DISASTER RESILIENCE. Source: Djalante et al., (2013, p.2113)

<table>
<thead>
<tr>
<th>Focus</th>
<th>Pathways for adaptive and integrated disaster resilience</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Integrated agendas</strong></td>
<td>1. Integrate DRR, CCA and development strategies</td>
</tr>
<tr>
<td><strong>Governance</strong></td>
<td>2. Strengthen polycentric governance architecture for DRR</td>
</tr>
<tr>
<td><strong>Sectoral integration</strong></td>
<td>3. Increase and coordinate cross sectors and multi-stakeholders collaborations</td>
</tr>
<tr>
<td><strong>Information management</strong></td>
<td>4. Improve knowledge and information through comprehensive and systematic assessment of hazards, risks, vulnerability and impacts</td>
</tr>
<tr>
<td><strong>Institutional Learning</strong></td>
<td>5. Facilitate institutional learning from implemented policies and experiences</td>
</tr>
<tr>
<td><strong>Self-organisation and networks</strong></td>
<td>6. Encourage and nurture self-organisation and networking</td>
</tr>
<tr>
<td><strong>Finances and risk</strong></td>
<td>7. Develop comprehensive disaster risk finance and insurance using a broad set of private and public instruments</td>
</tr>
</tbody>
</table>

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### 2.7.2. DRR-CCA CHALLENGES

Beyond the SIDS context, in general, issues with different knowledge, scales and norms (Birkmann and von Teichman, 2010) along with challenges related to governance issues seem to be hindering DRR-CCA in practice. Some governance problems are related to:

1. legislation (Birkmann and von Teichman, 2010; Djalante, 2013; Rivera et al., 2015; Nalau et al., 2016);
2. policy (Gero et al., 2011; Rivera et al., 2015);
3. mandates (Howes et al., 2015);
4. communication and coordination (Dhar Chakrabarti, 2010; Nalau et al., 2016);
5. monitoring (Nalau et al., 2016); and
6. capacity (Gero et al., 2011; UNDP et al., 2012).
Capacity constraints are related to human, financial and institutional failures. These include increased work-loads (Gero et al., 2011; Howes et al., 2015) and difficulties in sustaining coordination infrastructures (especially when externally funded) (Nalau et al., 2016). Political will has also been cited as a weak point with respect to capacity for DRR-CCA (UNISDR and UNDP, 2012; Howes et al., 2015). Strong political will to integrate DRR and CCA into development programming is necessary for success (Klein et al., 2007; UNISDR, 2015a).

There are also capacity challenges in coordinating the stakeholders involved in DRR-CCA (Nalau et al., 2016). These challenges have emerged from analytical frameworks such as the Earth Governance Framework which applies the concept of governance to adapting to global and local environmental changes in the context of sustainable development (Gero et al., 2010; Djalante, 2013); network governance (Howes et al., 2015) and; DRR systems perspective (Rivera et al., 2015). A risk governance perspective has however not been applied to identify possible challenges. Furthermore though country contexts have been shown to determine the uptake of risk governance approaches (Rothstein et al., 2013), the island context has not been previously examined for DRR-CCA risk governance. To date, most of the work considering challenges to DRR-CCA has focused on Pacific islands or other mainland contexts such as Nicaragua (Rivera et al., 2015) and Australia (Howes et al., 2015) but there has been limited examination of Caribbean small island contexts. This thesis therefore asks: What are the DRR-CCA risk governance challenges in Barbados, as a particular SIDS context? What is the role of islandness? Table 2-2 provides a summary of some of the challenges observed and geographic association with the findings though there is no evidence as yet to suggest that the mainland or island context is what influences the challenge.
<table>
<thead>
<tr>
<th>Challenge Theme</th>
<th>General Examples</th>
<th>Island Specific Examples</th>
<th>Mainland Specific Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scale-Time and Space</td>
<td>Longer CCA vs. shorter DRR planning time frames. Addressing both is problematic for decision makers (Birkmann and von Teichman, 2010; Chakrabarti, 2010).</td>
<td>None Identified (N. I)&lt;sup&gt;4&lt;/sup&gt;</td>
<td>• Reactive rather than pro-active government approach (Howes et al., 2015).</td>
</tr>
</tbody>
</table>
| Capacity- human resources, and institutional | • Strain to sustain coordination amongst sectors (Pacific). Increased work-loads and significant resource constraints in government (Australia) (Nalau et al., 2016).  
• Separate funding streams (Gero et al., 2011; Howes et al., 2015).  
• Lack of leadership (Howes et al., 2015).  
• Insecurity of political will, particularly when governments change (Howes et al., 2015).  
• Complexity of DRR and CCA information | Sustainability of external funding sources for DRR-CCA coordination (Pacific) (Nalau et al., 2016). | • Potential competition between agencies and levels of government for resources from traditional funding mechanisms for DRR-CCA (Howes et al., 2015).  
• Slow responses to local level problems that result in local alliances with others (NGOs and civil society for example) that do not share national priorities for integration (Rivera, 2014). |

<sup>4</sup> *NI* indicates that no studies were identified. The table is however not meant to be exhaustive but indicative of DRR-CCA examples.
<table>
<thead>
<tr>
<th>Challenge Theme</th>
<th>General Examples</th>
<th>Island Specific Examples</th>
<th>Mainland Specific Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Dhar Chakrabarti, 2010).</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Insufficient funds and expertise (UNDP et al., 2012; UNISDR and UNDP, 2012).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coordination and Communication functioning across scales</td>
<td>• Issues coordinating DRR-CCA across regional, and national levels and across multi-island states (Dhar Chakrabarti, 2010; Nalau et al., 2016).</td>
<td>• Uncertainty of roles and responsibilities in new arrangements (Pacific) (Nalau et al., 2016).</td>
<td>• High staff turnover affecting collaboration (Howes et al., 2015).</td>
</tr>
<tr>
<td></td>
<td>• Separate structures/ frameworks and organisations leading CCA and DRR globally, (Kelman and Gaillard, 2010), to regionally, and nationally- different ministries in separate government organisations and intergovernmental organisations (Birkmann and von Teichman, 2010; Chakrabarti, 2010; Djalante, 2013; Rivera et al., 2015).</td>
<td></td>
<td>• Negative perceptions of CCA in some contexts (Australia) (Howes et al., 2015).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Fragmented DRR systems for information acquisition and sharing across governance scales (community, national, regional) of scientific information (Nicaragua) (Rivera et al., 2015).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Traditional governing structures, ministries, departments, government hierarchy, that are not designed to address integrated responses across all levels of government but favour silo approaches; lack of trust (Howes et al., 2015).</td>
</tr>
<tr>
<td>Challenge Theme</td>
<td>General Examples</td>
<td>Island Specific Examples</td>
<td>Mainland Specific Examples</td>
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<tr>
<td>----------------</td>
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</tbody>
</table>
| Norms-legislation, cultural or behavioural standards | • Differing legislation and standards (Birkmann and von Teichman, 2010).  
• Isolation of the DRR and CCA legislation from other development related legislation (Djalante, 2013; Rivera et al., 2015; Nalau et al., 2016).  
• DRR and CCA are not a priority for development practitioners (UNISDR and UNDP, 2012).  
• Political will (UNDP et al., 2012; UNISDR and UNDP, 2012).  
• Disparate policies (Gero et al., 2010), | N. I | • Traditional legislation defines mandates and powers but creates barriers for collaboration (Howes, 2005; Howes et al., 2015).  
• Non-systematic review of policy, to ensure that DRR and CCA are incorporated in older legislation and can penetrate to local level such as DRR legislation and urban policy (Rivera et al., 2015).  
• Absence of protocols or legislation for sharing information and coordination (Rivera et al., 2015).  
• Different goals, standards, plans, objectives and methodologies for various agencies (Chakrabarti, 2010; Howes et al., 2015). |
| Knowledge-sources and types | • Mismatches of terms and definitions (Schipper, 2009; UNISDR, 2009b; Birkmann and von Teichman, 2010); including across scales of governance (Howes et al., 2015). | N. I | • DRR-related information gaps in environmental and socio-economic information of underlying risk factors (Dhar Chakrabarti, 2010).  
• Scientific Information on hazards and risk not |
<table>
<thead>
<tr>
<th>Challenge Theme</th>
<th>General Examples</th>
<th>Island Specific Examples</th>
<th>Mainland Specific Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• More information available for present climate compared to climate change (Birkmann and von Teichman, 2010).</td>
<td></td>
<td>in understandable formats (Rivera et al., 2015).</td>
</tr>
<tr>
<td>Monitoring</td>
<td>• Lack of monitoring and evaluation mechanisms (Nalau et al., 2016).</td>
<td>N. I</td>
<td>N. I</td>
</tr>
</tbody>
</table>
2.7.3. DRR-CCA PROSPECTS

Besides the identification of challenges to the DRR-CCA approach, important advances have been made with regards to prospects. Some prospects for DRR-CCA include scaling up of disaster management phases including response to address climate change (Birkmann et al., 2010). Scaled up activities include incorporating climate change considerations in the design of building codes (Birkmann et al., 2010). In addition, by giving more priority to creeping slow onset hazards activities can be scaled up. Furthermore, other scaling up efforts include, strengthening preparedness-early warning systems to consider slow onset hazards such as salinization. Emergency plans can also be expanded to include multi-dimensional vulnerabilities including climate change, response (flexibility in humanitarian assistance), recovery and reconstruction (building back with long-term views that consider climate change intensities) (Birkmann et al., 2010). These are a good start but help to maintain separate agendas and do not address undercutting issues of governance.

Prospects that address governance issues such as financial resources, coordination and collaboration have been identified. Financial prospects include flexible funding schemes that support long-term forward-oriented strategies for sustainability as opposed to short-term and project-oriented financing (Birkmann et al., 2010). In addition, the establishment of cooperative funding for DRR-CCA such as separate new funding for joint initiatives has also been suggested (Howes et al., 2015). Prospects that address coordination and collaboration challenges include, 1) developing a shared policy vision; (2) adopting multi-level planning; (3) integrating legislation; and (4) networking organisations to build a culture of collaboration. With respect to the latter, identifying collaborative champions within each agency in order to network, as well as collaborative disaster risk management (DRM), climate change, planning and health ministerial level sub-committees have been suggested (Howes et al., 2015). The scaling up of existing DRM networks was also found to have great potential for addressing DRR-CCA (Howes et al., 2015). The challenge is that there are limited practical suggestions for how DRR-CCA could be implemented to manage risks.

This thesis therefore examines how a risk governance approach could be applied to deliver practical DRR-CCA. By asking, ‘what are the prospects for establishing an integrated disaster risk reduction and climate change adaptation (DRR-CCA) development decision-making framework for Barbados as a SIDS (Small Island Developing State)?’ It examines prospects from the perspective of risk governance- an area not previously investigated.
2.8. DECISION-SUPPORT SYSTEMS

Risk governance decision processes employ various tools for decision support. These can include multiple criteria analysis (MCA), reports, expert consensus, stakeholder consultations, risk matrices, trial and error, surveys/questionnaires, personal experience and mental assessment (Renn, 2008; Mauelshagen et al., 2014). This is part of the technical and human resources that support the risk governance approach that was introduced in section 2.5.1 and that will be discussed in Chapter 4 (Paper 1).

Decision analysis can assist with considering the trade-offs between socio-political, environmental and economic impacts as well as various stakeholder views the decision maker has to make (Huang et al., 2011). It can require a Multi-decisions decision-making (MDDM) approach that sequences expenditure and allocation of scarce resources to optimize returns on investment over time. Multi-criteria decision analysis (MCDA) provides a methodology for the systematic consideration of multiple inputs for decision-making. Research (Huang et al., 2011) shows that MCDA in the environmental sciences are dominated by GIS/spatial applications based on a review over the period 2000-2009- assuming the trend has continued. Moreover, the same review demonstrated a disproportionate representation of applications to stakeholder participation interventions and natural resource management. It is not surprising that a number of spatial tools have been developed (Chen et al., 2001).

Demands for better transparency and accountability by the public has marked a shift from the more traditional decision support approaches to more flexible and engaging decision support tools which utilize a scenario approach as opposed to a forecasting approach. There are already examples in SIDS of web-based tools such as CCORAL (CCCCC, 2013) to support the consideration of risk by finance and planning government officials concerned with development decisions. CCORAL is not spatial however, but is a screening tool for identifying climate change and climate variability concerns at each step of the decision-making process. Tools for decision analysis, spatial decision making frameworks including Planning Support Systems (PSS), and spatial decision support systems (SDSS) for decision-making are needed that can also facilitate a much needed dialogue between policy makers, academia and wider stakeholders within an integrated, multi-dimensional and multidisciplinary framework (Kasemir et al., 1999; Ravetz, 2000). For a detailed review of the differences between the two approaches (traditional vs. spatial), see Nijkamp and van de Bergh (1997).
Spatial tools offer a benefit with respect to being more accessible and user-friendly (Prastacos and Diamandakis, 2000; Wegener and Fotheringham, 2000). Appendix 2 provides a typology of tools. All Decision Support Systems are computer-based, and enable problem solving from a basis of multiple solutions/alternatives and are characterized by flexibility and integration (Ayeni, 1997). PSS have originated from Spatial Decision Support Systems (SDSS) (Roy, 2005). Planning Support Systems (PSS) (Pelzer, 2016) are distinguished from Spatial Decision Support Systems by their capacity to facilitate multi-stakeholder discussions and engagement. PSS provide decision makers with the capability to handle problems strategically over a long-term policy period. SDSS incorporate a spatial dimension by way of the characterization of the problem or the solution (Wright and Buehler, 1993). Both PSS and DSS handle semi or ill-structured problems as well as modelling, database, and user interface components (Geertman and Stillwell, 2004). The PSS has the advantage of providing a user-friendly interface which can have GIS integrated in the framework though much more time and complexity are required for the development (Ayeni, 1997). Applications for PSS are growing (Geertman and Stillwell, 2009; Geertman et al., 2015). Interesting applications for the thesis is their use in evaluating the impacts of social policies (Ballas et al., 2007; Rae and Wong, 2012); as well as the use of internet and web-based applications to facilitate and increase public consultation and participation in environmental decision-making (Kingston et al., 2003). An example is *AtlasNW*, which is a regional integrated spatial decision support system that is an interactive sustainability atlas (Lindley, 2001). It uses interactive scenario models (QUEST), and a visualisation facility (Explorer), to explore issues and problems and processes. It also includes inter-linked components which allow the user to investigate particular aspects of individual scenarios in more detail (Lindley, 2001). Policy makers can assess the implications of alternative decisions and their impacts on sustainable development. The connection of the tool with an inter-linked planning support system (Harris and Batty, 1993; Klosterman, 1997; Geertman and Stillwell, 2009) deepens its analytical potential in areas of monitoring and holistic assessment of sustainability. It also provides a powerful tool for disseminating information to the wider public (Lindley, 2001). Some PSS are integrated and can combine dynamic simulations with expert judgment and are therefore quite useful for policy analysis. One example is the UK Climate Impacts Programme (UKCIP), which assists in generating data for climate change strategy and includes a record of the users’ vulnerability to current climatic variability; a prioritized list of climate risks; a list of possible adaptation measures to address those risks; adaptation options appraisal; and an implementation strategy. It provides a useful reference point for defining the functionality that a spatial framework could offer as a prospect for an integrated approach to DRR-CCA. Some gaps relate to quantifying the impacts.
of climate change on social and cultural aspects due mainly to limitations in data (Garg et al., 2007). More simplified systems are helpful for visualising climate risk and policy impacts e.g. Climate Just (Climate Just, 2014a).

Applications of GIS-based PSS have been used to a larger degree in the developed world particularly in Europe and in North America (Ayeni, 1997; Ravetz, 2000; Lindley, 2001; Kingston et al., 2003), however whilst there have been growing applications within the developing country context utility is still limited (Roy, 2005; Levy et al., 2007; Ramachandra and Sudhira, 2009). PSS may offer prospects for addressing the challenge of integrated DRR-CCA risk governance. They are not a panacea for addressing issues with risk governance however as they do have some limitations. For example, concerning the accurate representation of the very complex patterns and processes over varying timescales with limited data and incomplete knowledge (Lindley, 2001). This translates into uncertainty of input data layers and the modelling process, but it can be overcome by effective communication to users to inform their own value-judgments about scenario outcomes (Lindley, 2001). An integrated approach would be useful to tackle the other requirements of the risk governance approach. Barbados could build on some of the spatial tools that it has access to such as –DEWETRA or NCRIP being developed (mentioned at section 1.2) to see how they could support a PSS. For example, DEWETRA is hosted by a regional organisation, CIMH, and is a prototype for Caribbean countries adapted from an Italian tool. It has been made available free of charge for customization for the needs of the Caribbean. DEWETRA is supported by an existing maintenance framework, hardware, software and a back-up system. It allows for the display of up to date dynamic data as well as quasi-static data and information. It includes tools for tracking weather events as well as for building risk scenarios (UNDP, 2014). Data layers include infrastructure, land use, soils, and emergency resources. One challenge in using the DEWETRA would come with the modalities for sustaining the flow of updated information to the system- a point for discussion. In advancing a PSS prospect for DRR-CCA it would be helpful to avoid some of the pitfalls concerning the under usage of PSS. These are now discussed.

---

2.8.1. AVOIDING UNDER-USAGE OF PLANNING SUPPORT SYSTEMS (PSS)

There are three main reasons for under usage of PSS, they are related to instrumental quality, diffusion, and acceptance (Vonk, 2006). These are shown in Figure 2-10. Similar challenges are also found in the use of DSS (Calewaert et al., 2007; de Kok et al., 2009). Examples of instrument bottlenecks include a design that does not fit politician demands or the planning
tasks. This potential for political disconnection as a factor for under-usage and investment in interventions that could reduce risk was also mentioned at section 2.4.2. With respect to diffusion type problems, there are several, but insufficient uptake in the organisation setting is a prime bottleneck. Similarly there are diverse reasons related to acceptance of the system that include insufficient organisation facilitators, data related issues and lack of usefulness (Vonk, 2006). Lack of usefulness is similar to reasons cited by others such as a PSS that is not applicable (Aye et al., 2015). Organisation facilitators could be related to the lack of formal structures such as, rules and regulations, authority structures, prearranged roles and pre-set goals (bureaucracy) or the institutional mechanisms (Mansourian et al., 2006). Some call these challenges of bureaucracy (Gilfoyle and Thorpe, 2004; IPCC, 2012b). There can also be challenges from informal practices, norms and social relationships among the members of an organization (Caron and Bedard, 2002).

Similarly in a study on predictors of usefulness of PSS across the life cycle, a number of acceptance related features were found to be critical: top management support (organisational facilitator), user perceptions and intentions. For example, a lack of intension

to use the PSS could include lack of commitment. Roy, (2005) found that commitment is critical to success of these systems. User computer experience, support and training (could include having awareness and experience (Mansourian et al., 2006; Højberg et al., 2007), and the availability of external information sources (addresses data issues) are also important (Vonk, 2006; Diez and McIntosh, 2009). In addition the lack of involvement or participation has been highlighted (Roy, 2005; Diez and McIntosh, 2009) which could be a diffusion related issue concerning cooperation. Other predictors of use of the PSS not captured in Figure 2-10, could include external pressure, professionalism of the information system unit (Diez and McIntosh, 2009). Lack of flexibility can also be an issue (de Kok et al., 2009). These potential pitfalls are considered as well as associated lessons (Figure 2-11) for formulating a possible PSS prospect for DRR-CCA risk governance for Barbados.

Having identified these bottlenecks to the use of the PSS, there can be impediments to the use of the information generated. These can relate to the overarching challenges with risk governance discussed at section 2.5.2.

![Diagram](image-url)

CHAPTER 3. METHODOLOGY

3.1. INTRODUCTION

This chapter presents the research design and research paradigm that guided the methods applied. Following from this is a justification and explanation of the methods employed and the information that they provided to answer the research questions associated with each research objective mentioned at section 1.1. The research was conducted in four stages that corresponded with each research objective.

3.2. METHODOLOGICAL FRAMEWORK

Table 3-1 provides an overview of the methodological framework applied and the interconnections between the four stages of the research. In the first stage, a literature review was conducted. This stage provided the conceptual framework that informed the methodological framework for answering the research questions in subsequent stages 2, 3 and 4. These successive stages employed a case study approach (see section 3.5 for further details). Utilising the case study approach, a mixed methods approach was employed that gathered data from semi-structured surveys, documents, and semi-structured interviews during a 6-month fieldwork period in the case study country- Barbados. Before elaborating on the methods employed, the following section presents the research design that informed the methodological framework.
**Aim**

*To evaluate the prospects for establishing an integrated disaster risk reduction and climate change adaptation (DRR-CCA) development decision-making framework for Barbados*

**Objectives**

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>To develop a conceptual framework for integrating DRR and CCA risk governance decision-making processes in SIDS.</td>
<td>To evaluate the extent to which existing DRR and CCA institutional structures and processes in Barbados already exhibit the potential for DRR-CCA integrated risk governance.</td>
<td>To analyse the challenges to successful integrated DRR-CCA risk governance in Barbados as a SIDS.</td>
<td>To make recommendations to the Government of Barbados, and policy making organisations working to address DRR and CCA in SIDS.</td>
</tr>
</tbody>
</table>

**Stages**

- Development of a DRR-CCA Risk Governance conceptual framework for SIDS to determine the potential for DRR-CCA (Paper 1- Chapter 4)
- Evaluation of existing DRR and CCA institutional structures and processes and the potential for DRR-CCA integrated risk governance in Barbados (Paper 2- Chapter 5)
- Analysis of the challenges to integrated DRR-CCA risk governance (Paper 3- Chapter 6)
- Identification of prospects for a DRR-CCA development decision-making frameworks for Barbados and reflection on policy and practical implications of the research findings for Barbados and for SIDS (Chapter 7)

**Methods**

- Literature Review
- Document Collection
- Semi-structured interviews
- Surveys
- Participant observation

**Analysis**

- Qualitative Document Analysis
- Thematic Analysis
- Descriptive Statistics
- Social Network Analysis

**Synthesise Findings from Stage 1, Stage 2 and Stage 3**

*Recommendations for establishing an integrated disaster risk reduction and climate change adaptation (DRR-CCA) development decision-making framework for 1) Barbados as a SIDS and 2) for policymaking organisations working to address DRR and CCA in SIDS.*
Methodological approaches may be classified as quantitative, qualitative or quantitative-qualitative (Punch, 2013). A quantitative strategy suggests that reality can be objectively known by the objective measurement of aspects of social life (De Vaus, 2006) whereas a qualitative strategy is based on the subjectivity of reality (Denzin and Lincoln, 2000). This research applied a quantitative-qualitative or mixed methods approach since the research questions would benefit from the perspectives that both of these approaches offer. A mixed methods approach also gives a more rounded view of the problem revealing different aspects of the empirical reality (Flick, 1998). It also provides stronger evidence for a conclusion through convergence and validation of findings (Johnson and Onwuegbuzie, 2004). In this regard to ensure rigour and ensure that the best method was applied to answer the research questions, a mixed methods approach was taken. Since this research is positioned between quantitative and qualitative strategies it is necessary to consider the characteristics of each approach that informed this study as well as the methodological implications.

In line with the quantitative strategy’s methods, surveys were used to generate numbers and empirical findings. In contrast, the qualitative approach is associated with methods such as in-depth interviews, and participant observation that generate textual as well as in some cases non-textual forms of data such as pictures and film (Bryman, 2012; Durand and Chantler, 2014). The study focused on textual data. It further relied on the qualitative approach to provide an in-depth understanding of the social phenomenon being investigated (Durand and Chantler, 2014); which was the prospects for establishing a framework for integrated risk governance in SIDS. By using a quantitative-qualitative methodological approach, two perspectives on the risk governance structures and processes operating could be generated. This would give a more complete presentation and evaluation (Bergman, 2008; Johnson and Onwuegbuzie, 2004) of the potential for DRR-CCA risk governance decision-making frameworks. The application of the quantitative-qualitative strategy therefore placed this study within a pragmatic paradigm (Johnson and Onwuegbuzie, 2004). Furthermore because the research questions mainly focused on establishing descriptions of what are the characteristics and patterns concerning the potential and challenges to DRR-CCA described by respondents, an inductive research strategy was applied (Blaikie, 2010). The study employed some theory testing related to how smallness influenced the potential for DRR-CCA in social networks. In this regard it employed a deductive strategy (Blaikie, 2010). As the principal aim of choosing the research strategy should be to achieve the best approach for answering the research question (Blaikie, 2010), two strategies were employed. The research
strategy informs the methods, data and paradigms that structure the research (Blaikie, 2010). In line with the qualitative approach in-depth meaning and understanding was produced through an inductive approach to interpreting the knowledge generated (Blaikie, 2010). The method was chosen because it also offers the researcher close interactions with participants (Blaikie, 2010).

3.4. RESEARCH PARADIGM: PRAGMATIC PARADIGM

The paradigm is a basic set of beliefs that guide disciplined inquiry about how problems should be understood and addressed (Guba, 1990). It sets out the beliefs concerning what is the nature of the knowable (ontology), the nature of the relationship between the knower and knowable (epistemology) and how the inquirer should go about finding knowledge (methodological) (Guba, 1990). There are a number of paradigms. This research applies the pragmatic paradigm (Johnson and Onwuegbuzie, 2004; Rorty et al., 2004; Morgan, 2007). It is a combination of positivism and interpretivism also called interpretivist or constructivist paradigms, though more interpretivist. In this regard, the study benefits from both of these paradigms (Morgan, 2007).

The positivism perspective which is associated with quantitative methods offers a single and measurable reality (Blaikie, 2010) whereas the interpretivist perspective that is associated with qualitative methods offers a constructed reality (Blaikie, 2010). This means that meaning is produced and reproduced from people’s interactions with the world around them (Crotty, 1998; Blaikie, 2010; Punch, 2013). The interpretivist perspective means that the study acknowledges multiple realities (Denzin and Lincoln, 2008) and that this needs to be interpreted. It also assumes that understanding of the phenomenon under investigation is co-produced through an interactive relationship between the researcher and the participant (Miles and Huberman, 1994; Denzin and Lincoln, 2008). Notwithstanding, the positivism aspect of the pragmatic paradigm offers the researcher ‘objectivity’ as the research is understood to be detached from the topic (Blaikie, 2010). Arguably there is no such thing as objectivity since this approach reproduces and reflects biases in the tools developed to ascertain knowledge (May, 2011). Nevertheless this paradigm allows for general observations from which general statements of the population as a whole could be made (Blaikie, 2010). This paradigm was suitable because basic measurements could be obtained to characterize the network potential for DRR and CCA risk governance in SIDS. The pragmatic approach therefore allowed the researcher to move between a constantly changing reality of, what could be ‘objectively’ measured and what was being ‘constructed’ (Johnson
Applying this approach allowed the best method - whether quantitative or qualitative to be applied in order to solve the research questions. Table 3-2 gives an example of how the pragmatic paradigm was applied in stage 2 and stage 3 of the study.

**TABLE 3-2: APPLYING THE PRAGMATIC PARADIGM AS APPLIED IN STAGE 2 AND STAGE 3**

<table>
<thead>
<tr>
<th>Section</th>
<th>(Stage 2) Description</th>
<th>(Stage 3) Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research objective</td>
<td>• To evaluate the extent to which existing DRR and CCA institutional structures and processes in Barbados already exhibit the potential for DRR-CCA integrated risk governance.</td>
<td>• To analyse the challenges to successful integrated DRR-CCA risk governance in Barbados as a SIDS.</td>
</tr>
<tr>
<td>Ontology (nature of reality)</td>
<td>Positivism • Reality is objective. The strength of relationships in the communication process network for risk governance could be measured.</td>
<td>Interpretivist • Reality is constructed based on practitioner and decision maker experiences with implementing DRR and CCA • The socially constructed reality resulting from the DRR and CCA experience exists due to practitioners' knowledge, views, interpretations and experiences of being part of the DRR and CCA processes in Barbados. • Multiple realities exist, that is, reality is relative to the interviewee.</td>
</tr>
<tr>
<td>Epistemology (relationship between the knower and)</td>
<td>• DRR and CCA practitioners have facts concerning how they share</td>
<td>• DRR and CCA practitioners and decision makers were active in the research process and were able to socially construct knowledge of</td>
</tr>
<tr>
<td>Section</td>
<td>(Stage 2) Description</td>
<td>(Stage 3) Description</td>
</tr>
<tr>
<td>---------</td>
<td>-----------------------</td>
<td>-----------------------</td>
</tr>
</tbody>
</table>
| knowable | DRR and CCA risk governance information that exists prior to and independently of the research.  
• Scales and matrices of fixed questions can be used to systematically record these facts. | the DRR and CCA process based on their first-hand experience.  
• Both DRR and CCA practitioners and decision makers who had experience of risk governance processes and the researcher were co-producers of knowledge, based on their active and participative interaction during the research process.  
• The DRR and CCA experiences of DRR and CCA decision makers and practitioners were understood and recounted through mental processes influenced by the SIDS context- being residents in a SIDS. |
| Methodology (methods used to find out knowledge generated) | • Data was collected through an online survey with DRR and CCA practitioners and decision makers.  
• Descriptive statistical measurements of perceptions and measures for network characteristics. | • Data were collected through semi-structured interviews with DRR and CCA practitioners and decision makers with day-to-day experience of risk governance.  
• Interactions with key decision makers.  
• Reflective account of the researcher on the research process.  
• Research interpretation is influenced by the theoretical perspective of the researcher. |
The research design provides structure for guiding the data collection, analysis and interpretation of the study (Yin, 2003). Given the research questions, and the approach to be used in gathering, generating and analysing the data, a case study approach (Yin, 2003) was chosen as opposed to other types of designs- experimental, longitudinal or cross-sectional (De Vaus, 2001). The ‘experimental’ design was not applicable since it was not comparing how different groups responded to different interventions compared to any control group. A longitudinal design was not suitable, as the study was not examining the impact of any particular DRR-CCA intervention on a particular group over time. Additionally, a cross-sectional design was not applied because the study did not aim to examine how variations in any outcome variable were linked to group differences. The focus rather was on the thorough analysis of an individual case, Barbados, taking into consideration information about the context. Figure 3-1 gives an overview of the research design applied in this research and its connections with the research strategy and paradigm discussed in the foregoing sections 3.3 and 3.4 respectively. The case study design allows the researcher to be close to real-life situations and allowed in-depth details about the prospects for establishing an integrated DRR-CCA development decision-making framework. Being able to access in-depth details through the case approach facilitated a meaningful understanding of human behaviour which cannot alone be ascertained from theory proving (Flyvbjerg, 2006). The context dependent knowledge provided by case studies offers valuable examples that are needed to strengthen the understanding that predictive theories and universals cannot alone provide. The characteristics of the case can allow for powerful contributions to knowledge (Flyvbjerg, 2006) to be made. In this research, therefore rather than taking a wide cross section of cases as is typical for adding rigour (Giddens, 1984), one case was applied and maximum information was extracted (Flyvbjerg, 2006). Given that the research topic of integrated DRR-CCA risk governance is the first of its kind for SIDS, the study was designed to give initial information on how the approach could be applied in SIDS.

Barbados was selected as the case of focus because it represents a SIDS that has high human development status, high governance status, and initiatives towards improved decision making for DRR and CCA (discussed in section 1.2). These characteristics are particularly important for the investigation of DRR-CCA integrated risk governance because it allows for a focus on particular other features of governance that may affect DRR-CCA rather than developing country status alone or weak governance structures which are typical impediments to reducing risk. A second reason for the focus on Barbados is that it is a case of
a single island and central government SIDS structure for DRR-CCA risk governance. By using the case of Barbados the challenges associated with coordinating various jurisdictions e.g. regional, national or local level structures that usually affect integrating DRR-CCA are avoided that have been previously identified issues from multi-island state contexts concerning communication and the case can therefore highlight other potential challenges and prospects for DRR-CCA that have not yet been identified. Given these two reasons, the Barbados case allows for challenges related to risk governance to be crystallised from other governance problems. In addition notwithstanding these peculiarities of the Barbados case, Barbados is a typical SIDS that satisfies all of the criteria of islandness, smallness, and developing hence there are prospects that will emerge from the case that will be transferrable to other SIDS.

FIGURE 3.1: OVERVIEW OF RESEARCH DESIGN
3.6. ENSURING RIGOUR IN THE MIXED METHODS APPROACH

While the mixed method approach satisfies the requirements of the research questions, connecting two paradigms however requires care to ensure the appropriate application when constructing and answering the research questions (May, 2011). Quantitative and qualitative strategies have two different standards—some overlapping but others quite distinct (Bergman, 2008). In this regard, careful consideration of quality issues at the data collection stage, the analysis stage, the inference stage and at the stage of integration are necessary to allow for a rigorous application of the mixed methods approach (Bergman, 2008). This includes typical methods for ensuring that design and inference rigour but also additional checks to ensure that the ‘meta’ inference from both the qualitative and quantitative strands of the research, are adequately incorporated. To do this, stage 3 of the research employed a qualitative strategy only and Stage 2 applied both quantitative and qualitative strategies. Two separate strands of analysis were applied at stage 2. Final inferences from each strand were kept separate and thereafter there was adequate incorporation of the inferences made from each strand of analysis. Furthermore, checks for interpretive and theoretical consistency are made to ensure agreement and distinctiveness in the inferences made (Bergman, 2008).

To ensure further rigour in the research both methods were applied to answer the same question, i.e., triangulation (Stake, 2008; Blaikie, 2010). Data collected at stage two from document analysis was triangulated against the survey methods to provide better evidence from network calculations on the potential for integration. Moreover at stage three semi-structured interviews allowed for corroboration (Denzin, 2012) and elaboration (Flick, 1992, 2007) of survey findings on risk governance challenges with further validation (Denzin, 2012) from participant observation.

Figure 3-2 provides a summary of the research design. At the core of the design are the research questions which were informed by the conceptual framework. The framework was guided by the goals of the study. The questions informed the methods. This was an interactive process after Maxwell, (2012) as opposed to sequential decisions that confirmed methodological rigour (Janesick, 1994).

In the following section, a detailed account of the methods employed in the conduct of, Stage one, Stage two and Stage three is presented and the information they generated. This provides evidence of how the criteria of rigour were applied, as a basis for accepting the answers submitted in response to the aim and objectives of the research, as valid.
GOALS
(Why do I need to know this?)
To help improve the connection between theory and policy/practice in SIDS for integrated DRR and CCA risk management strategies that address their climate crisis.

METHODS
(What kind of data and analysis method will answer the research questions?)
1) Surveys; 2) Semi-structured interviews; 3) Participant observation; 4) Document analysis; 5) Thematic analysis and 6) Social network analysis.

RESEARCH QUESTIONS
(What do I need to know?)
1. How can a framework for integrating DRR and CCA risk governance be conceptualised in SIDS?
2. How do existing DRR and CCA institutional structures and processes in Barbados exhibit the potential for integrated risk governance?
3. What are the DRR and CCA risk governance challenges in Barbados, as a particular SIDS context?
4. What are the prospects for a DRR-CCA development decision-making framework for Barbados?

CONCEPTUAL FRAMEWORK
(How did I know what I know?)
1. Own background as a Caribbean disaster management professional
2. Literature review on DRR and CCA risk governance and integration and SIDS features
3. Theories of DRR and CCA integration, risk governance, disaster risk reduction, adaptive governance, joined up governance and risk society.

ENSURING RIGOUR / VALIDITY
(What processes are in place to guide the study?)
1) Established methodological criteria; 2) Regular meetings with supervisors; 3) Triangulation and 4) Two separate strands of analysis for quantitative and qualitative data.

FIGURE 3-2: RESEARCH DESIGN SHOWING INTERACTIVE PROCESS AFTER MAXWELL, (2012), P.5
In this section, detailed descriptions and critical analysis of the methods employed, is presented. Additionally, the data generated from each method as well as the methods of analysis applied that generated answers at each research stage for each research question is also reviewed.

As an overview, stage 1 consisted of a literature review that informed the analysis of the other 3 stages of the research. Based on the conceptual model in stage 1, stages 2 and 3 involved participants from organisations that would have a role in DRR and CCA risk governance in Barbados. Stage 3 focused particularly on the perspectives of leading DRR and CCA risk governance institutions in Barbados at the technocrat and high-level decision-making levels (See Appendix 3). Stage 2 captured all other organisations. Stage 2 primarily applied quantitative methods of data collection. In particular, online and in person surveys were administered which were complemented by secondary data sources of key legislative planning documentation. In stage 3, semi-structured interview methods were employed. Data collected at stage 2 was analysed using descriptive statistics, social network analysis (Borgatti, 2002) and document analysis (Bowen, 2009). Stage 3 applied thematic analysis (Braun and Clarke, 2006) to the interview data collected. Rigour in the data analysis was ensured using strategies as mentioned at section 3.6. Data generated included 13 documents, 16 surveys and 16 anonymised interview transcripts. Before the details of the methods for each objective/stage are reviewed the positionality of the researcher and ethical procedures followed are reviewed.

3.7.1. RESEARCHER POSITIONALITY AND GAINING ACCESS TO PARTICIPANTS

The researcher has certain characteristics which could be considered as placing her in a privileged position for conducting the research. These included:

1. Born and raised in Barbados
2. Worked in disaster management in the government and regional agencies in the Barbados network
3. Familiarity with key stakeholders at national and regional levels

The researcher believes that these characteristics helped participants to be more comfortable and forthright with sharing their experiences on the topic. It helped with understanding
deeper meanings that are often captured in some Barbadian dialect terms, whereas another researcher may not have had this insight. Being a former public servant and regional colleague to many of the actors also seemed to help with gaining access to participants to some degree. Notwithstanding, since participants were required to represent their organisations and to be comfortable in doing so and to heighten the importance of participation, it was necessary to align the study with a well-respected and acknowledged entity. Outside of establishing this, gathering responses would have been difficult in Barbados. Research has shown that entities that provide access to hard to reach populations are a great research asset in recruiting research participants (Emmel et al., 2007). These individuals and institutions are referred to as gatekeepers (Donley, 2012). In this study participants were accessed through the Department of Emergency Management (DEM) who acted as a gate keeper. The DEM is the main government agency concerned with disaster management in Barbados. This was achievable in part due to the researcher’s former employment with the DEM and seven-year relationship through the regional ‘parent’ organisation CDEMA. In addition, it also meant that the researcher was familiar or had interacted with many of the targeted organisations for the study within the last year prior to the study. It also helped that the researcher was a national of Barbados. The researcher’s use of the DEM as a gate keeper reflected the agreeableness, trust, and relationship presence necessary for accessing participants (Burgess, 1984; Emmel et al., 2007). The assistance of DEM was confirmed through an official request from the researcher for the DEM to host the research for the six-month period of fieldwork. During this period, the researcher was working from the organisation. This involved the researcher working from the office of the DEM, being collegial, attending meetings with the DEM, and providing inputs as requested—particularly assisting in the development of an integrated DRR-CCA work programme for Barbados. Because of the support of the DEM, official correspondence from the DEM head, to government and private sector organisations was issued introducing the study, researcher and inviting participation. This close working approach with the DEM also enabled access to high-level decision makers—such as the Minister responsible for Disaster Management facilitated through the auspices of the DEM.

Potential for bias and coercion that may have resulted from the researcher’s previous linkages with the DEM and the familiarity with the stakeholder network discussed were managed in two ways. As was mentioned, the researcher built a close working relationship with the DEM—by working from the office of the DEM, being collegial, attending meetings with the DEM, and providing inputs as requested. In order to guard against coercion and to manage expectations, the researcher had introductory meetings with the heads of the organisations to explain the research and clarify expectations. While in the case of the DEM
particular coercion or pressure was not experienced, in seeking to build a similar working relationship with another core organisation—this was experienced. For example in order for cooperation to engage with the researcher, the agency wanted to know what they would get in return and had identified a number of projects that they wanted completed in exchange for cooperation. Being cognisant of the amount of time available to do the research the researcher through the introductory meeting was able to explain the time constraints and re-emphasise the focus of the work. In addition she managed her time by limiting the time that she worked directly from this organisation.

With respect to managing bias the researcher employed two main approaches—for example in the case of the DEM because of the previous working relationship, the researcher was still seen as a work colleague. Some DEM employees commented that they thought she had returned to continue working at the DEM, further the office space that she was allocated was in the same space from which she worked before and she was also invited to attend several meetings on behalf of the DEM. In order to keep the research focus clear, the researcher requested a space where she would be separated from the day to day work flows of her previous job—ultimately downstairs from the activity upstairs and limited the time spent in the office, particularly to only prepare the correspondence needed and for meetings with key staff.

In order to guard against recording preconceived findings because of her extensive knowledge of the network, she used the interview guide to ensure a systematic approach to questioning. She also transcribed every interview verbatim and coded systematically across transcripts with the help of electronic coding software—Nvivo—to minimise bias. She also used a structured approach to the thematic analysis to ensure representativeness of the findings across the transcripts. This is discussed in section 3.10.2.1 C and E and 3.10.3.
As the research engaged with human subjects, ethical consideration was necessary (Donley, 2012). The risk to participants was assessed to be minimal since the topic was not sensitive or personal nor would it be one to cause discomfort, distress or inconvenience. This is because it concerned professionals in non-threatening daily professional roles. Moreover, the research did not include vulnerable persons such as children and disadvantaged people groups. The foremost ethical issues in this research were related to data security and voluntary participation in the observations to be undertaken of the processes in the organisation. To this end, all data was collected under the strictest confidentiality for the survey, interviews and participant observation methods of data collection. Ethical approval for the study was granted by University of Manchester Research Ethics Committee Ref: MB/SEAG55/Dec/14 (Appendix 4).

For the survey, no names were collected only the names of the organisations that they represented. All measures were taken to secure the data and the anonymity of the participant. This also included the use of a secure online survey host. In accordance with ethical considerations for voluntary participation, participants were allowed to skip sections of the survey if they wanted to. Recorded interviews along with verbatim transcripts were stored on an encrypted laptop and uploaded to a secured University of Manchester network drive (P). Furthermore, written consent forms, data sheets, workshop reports and field notes were stored separately in a locked cabinet where only the researcher had access.

With respect to interviews, all data collected were anonymised and reported in an anonymised way. Pseudonyms and codes were applied to all transcripts for all research participants in order to maintain anonymity and confidentiality of interviewees as an ethical standard (Patton, 2015), though given the nature of the research respondents would not be any harm should their names be revealed. The research interviews were conducted in an office/ professional environment during office hours where safety was paramount and privacy, and at mutually agreeable times to avoid any inconvenience and to minimise disruption to schedules and participants. All interviews were voluntary and all participants were given the opportunity to withdraw at any time. Approval for publication was also sought as well as the use for direct quotes. Similar ethical standards were pursued for participant observation, which was on a voluntary basis only and by approval, by the head of the organisation where observations were taking place.
In accordance with research being carried out with human participants, receiving consent was principle to participating in the study (Israel and Hay, 2006; Patton, 2015). The research adhered to standards of ensuring that prior to participating, participants were fully aware of what they were committing to, without coercion or manipulation (Israel and Hay, 2006). In this regard, a Participant Information Sheet (PIS) (Appendix 5) was developed and included on the opening page of the survey or as a separate written consent sheet on the approved informed consent form (Appendix 6 and Appendix 7). The PIS used easy to understand terms explaining the purposes and expectations of the research. It required the participant to agree before they could proceed with the survey questions. Informed consent was given by all participants for their interviews to be audio recorded. In the following sections, the methods and information generated for each objective of the thesis are reviewed.
3.8. STAGE 1- DEVELOPMENT OF A RISK GOVERNANCE CONCEPTUAL FRAMEWORK FOR SIDS

Table 3-3 provides an overview of the methods applied and the data required for objective 1. How this method was applied follows.

TABLE 3-3: METHODS OVERVIEW FOR STAGE 1

<table>
<thead>
<tr>
<th>Research Objective 1:</th>
<th>To develop a conceptual framework for integrating DRR and CCA risk governance decision-making processes in SIDS (in Chapter 4).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research Questions:</td>
<td>How can a framework for integrating DRR and CCA risk governance be conceptualised for SIDS?</td>
</tr>
<tr>
<td></td>
<td>• What are the SIDS features that the framework should respond to?</td>
</tr>
<tr>
<td></td>
<td>• What are the DRR-CCA requirements for the framework?</td>
</tr>
<tr>
<td></td>
<td>• How could a risk governance framework incorporate the peculiar development characteristics with which SIDS are associated?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Research sub-stages</th>
<th>Research methods</th>
<th>Data requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Determine SIDS features and DRR-CCA requirements for risk governance.</td>
<td>Literature review</td>
<td>• Literature on:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>o SIDS features</td>
</tr>
<tr>
<td></td>
<td></td>
<td>o DRR-CCA requirements</td>
</tr>
<tr>
<td>2. Identify DRR-CCA framework requirements</td>
<td></td>
<td>o DRR-CCA risk governance frameworks</td>
</tr>
<tr>
<td>3. Identify a suitable DRR-CCA risk governance framework</td>
<td></td>
<td>o Mechanisms to address DRR-CCA gaps and development requirements for SIDS.</td>
</tr>
<tr>
<td>4. Identify possible mechanisms through which identified DRR-CCA gaps and development requirements for SIDS can be addressed and prepare a conceptual framework for DRR-CCA risk governance in SIDS.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3.8.1. LITERATURE REVIEW

A literature review was conducted to collect and generate data for the development of the conceptual framework. The data collected was analysed using a simplified form of document analysis (a more detailed form of document analysis is described at section 3.9.1) that was applied to literature obtained from electronic databases from Web of Knowledge. Document analysis combines aspects of content analysis and thematic analysis (Bowen, 2009). Four categories of literature (published documents) were identified for collection based on the research sub questions in Table 3-3. Four themes were used to select relevant documents: 1) SIDS features, 2) Integrating DRR and CCA 3) DRR-CCA frameworks and 4) risk governance and governance frameworks. Databases were searched using combinations of the following key terms: small island developing states, disaster risk reduction and climate change adaptation and integration, risk governance, smallness and governance (4614 results). Data searches were saved in web of science and data was managed using Mendeley, which is bibliographic software. From these results, 21 key papers were selected, based on the level of contribution to each theme (see Table 3-4).
The conceptual framework was developed from a summarization of the attributes found for SIDS and for DRR-CCA frameworks identified in sub-stage 1 and sub-stage 2. In the next step (sub-stage 3), the documents about frameworks for DRR and CCA integrated risk governance were selected and one framework was selected that provided an overall risk governance approach, and incorporated both CCA and DRR (see section 2.6 and Paper 1). Thereafter (sub-stage 4) the SIDS and DRR-CCA attributes identified at sub-stage 3 were applied to evaluate the strengths and gaps of the risk governance framework for adaptation to SIDS. Further themes were developed based on the evaluation of features identified as necessary for SIDS risk governance-systems, joining-up and adaptive capacity (See Chapter 4- Paper 1). These were then used to select literature that provided information on how the missing

<table>
<thead>
<tr>
<th>Study</th>
<th>Themes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nurse and Moore, 2005; Mimura et al., 2007; Briguglio, 1995, 2003</td>
<td>Integrating DRR and CCA</td>
</tr>
<tr>
<td>Birkmann et al., 2013; O’Brien and Downing, 2013; A Gero et al., 2011; Birkmann and von Teichman, 2010; Kelman and Gaillard, 2010</td>
<td>x</td>
</tr>
<tr>
<td>Biermann, 2007; Ortwin Renn, 2008; Lebel et al., 2010; Klinke and Renn, 2012; van Asselt and Renn, 2011; Folke, 2006; Baird et al., 2016</td>
<td>x</td>
</tr>
<tr>
<td>Djalante et al., 2013; Howes, 2014; Birkmann et al., 2013; Papathoma-Köhle et al., 2016; Forino et al., 2015</td>
<td>x</td>
</tr>
</tbody>
</table>
elements could be addressed. Finally, this was applied to draw up a conceptual framework for DRR-CCA risk governance in SIDS.

3.9. STAGE 2- EVALUATION OF THE POTENTIAL OF EXISTING DRR AND CCA INSTITUTIONAL STRUCTURES AND PROCESSES FOR INTEGRATION

Table 3-5 provides an overview of the methods applied and the associated research objective and sub questions. The data for stage 2 were collected by way of documents and surveys. Documents provided information on structures in principle and surveys were applied to ascertain information about what was practiced from the perspective of organisations mainly outside of the core of DRR and CCA risk governance in Barbados. As shown in the methodological framework (section 3.2), three types of analysis were applied: document analysis, social network analysis (SNA), and descriptive statistics. The background on each method and how it was applied for data collection and analysis is discussed in the subsequent sections.
**Research Objective 2:** To evaluate the extent to which existing DRR and CCA institutional structures and processes in Barbados already exhibit the potential for DRR-CCA integrated risk governance.

**Research Questions:**
- How do existing DRR and CCA institutional structures and processes in Barbados exhibit the potential for integrated risk governance?
  - What are the existing DRR and CCA risk governance institutions and processes in principle and practice?
  - How are features of integrated DRR -CCA risk governance exhibited in the structures and processes for risk governance in principle and practice?
    - What is the potential shown by interactions and interconnections across structures and processes for integrated risk governance as revealed by social network analysis?

<table>
<thead>
<tr>
<th>Research sub-stages</th>
<th>Research methods</th>
<th>Data requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investigate what are the DRR and CCA risk governance structures and processes in principle and the integration features exhibited.</td>
<td>Document Analysis</td>
<td>Key DRR and CCA legislation and policy with descriptions of risk governance processes, approaches and institutions.</td>
</tr>
<tr>
<td>Examine the features of integrated DRR -CCA risk governance exhibited in the structures and processes in principle.</td>
<td>Document Analysis</td>
<td></td>
</tr>
<tr>
<td>Investigate what are the DRR and CCA risk governance processes and institutions in Barbados in practice.</td>
<td>Descriptive Statistics</td>
<td>Risk governance processes and institutions. Interconnections and interactions across structures and processes.</td>
</tr>
<tr>
<td>Examine the features of DRR -CCA risk governance exhibited by social networks in practice.</td>
<td>Social Network Analysis</td>
<td>Risk governance processes and institutions. Interconnections and interactions across structures and processes.</td>
</tr>
</tbody>
</table>
3.9.1. DOCUMENT ANALYSIS

According to Bowen, (2009), ‘Document analysis is a systematic procedure for reviewing or evaluating documents—both printed and electronic (computer-based and Internet-transmitted) material’ p. 27. This method was suitable for investigating the DRR and CCA processes and structures in principle in terms of the extent to which existing governance structures for DRR and CCA already connect with one another (objective 2). It offered time and cost efficiency and easy access to data since documents were easily available (Bowen, 2009). This analytical approach also offered good coverage in terms of timespan and context (Yin, 1994) relating to risk governance. Though it may be applied as a stand-alone or complementary method (Bowen, 2009) it was used as a complementary approach to compare and also validate findings of ‘in principle’ (from the documents) versus findings of ‘in practice’ that may have emerged from the surveys. Additionally, it was used to provide additional information (Denzin, 2012) to what was captured in the survey method.

While details on how to apply document analysis are not profuse, Bowen (2009) provides an outline of the process. This approach was used in this thesis. It has five main steps:

1) Objectivity and sensitivity when selecting and analysing data,

2) Document interpretation within context,

3) Authenticity, credibility, accuracy of documents selected,

4) Applicability of selected documents to the conceptual framework- fit for purpose, and,

5) recognition of the representativeness of selected documents- whether complete or selective in treatment of the topic or in terms of the detail that the documents provide overall of the topic of interest- balanced or uneven.

The following section describes how these steps were applied.
3.9.1.1. DATA COLLECTION

Finding and choosing documents is one of the first steps of the document analysis (Bowen, 2009). For this step, documents were selected that could be accessed online from reputable organisations for example this included government organisations, regional and recognised international UN organisations. Some documents could only be accessed in hard copy through the organisation of interest. Searches were done using the Google search engine, for legislation, policies or plans related to the areas of interest. To ensure authenticity and credibility (Bowen, 2009) only those documents that were adopted by the government or institution were included in the study. There was one exception, where the document was included that was being utilised but not officially adopted (as was the case of the Draft Climate Change Policy). In most instances, the documents were available from the organisation of interest’s website or the Parliament of Barbados website. As mentioned in the previous section, objectivity and the applicability of the documents selected are essential. In this regard, only those documents that provided information on key sector leader activities and responsibilities for DRR and CCA risk governance in Barbados were selected. Therefore, only national and regional legislation; policies and plans were collected. As Bowen, (2009) indicates, a few carefully selected cases can be effective for addressing the verification needs of the research. In total 13 documents were collected that were applicable and credible. See Table 3-6 for the full list of documents.

<table>
<thead>
<tr>
<th>Legislation and Policy</th>
<th>Focus</th>
</tr>
</thead>
<tbody>
<tr>
<td>6. Soil Conservation (Scotland District) Act, Cap 396 (1998a)</td>
<td>Landslide management and planning</td>
</tr>
<tr>
<td>8. Coastal Zone Management Act, Cap 394 (1998a)</td>
<td>Coastal management</td>
</tr>
<tr>
<td>Legislation and Policy</td>
<td>Focus</td>
</tr>
<tr>
<td>----------------------------------------------------------------------------------------</td>
<td>--------------------------------------</td>
</tr>
<tr>
<td>12. Caribbean Community Climate Change Centre (CCCCC) Policy and Plan (2011)</td>
<td>Regional climate change adaptation</td>
</tr>
</tbody>
</table>

3.9.1.2. ANALYSIS

I now turn to the assessment aspect of document analysis and finally how the data that was found was combined. In line with the accepted process, aspects of content analysis and thematic analysis were combined for the assessment (Bowen, 2009). The latter being a more focused review of the data as opposed to simply text identification. The document analysis focused on a search for content related to five pre-identified themes of integration based on the conceptual framework developed in Stage 1 of the research. These are discussed Chapter 4, Paper1- section 1.4. The first three themes, correspond with core and supporting aspects for DRR-CCA- 1) 'development approach', 2) 'systemic approach', and 3) 'joined-up governance'. The final 2 themes, 4) 'coverage of the risk governance process', and 5) 'communication potential' are the main processes of the risk governance. Each theme was expanded into specific sub-categories that were used to code and cross-examine the documents collected (see Table 3-7). The results were extracts, quotes, or entire portions of text that were structured according to major themes (Bowen, 2009).
<table>
<thead>
<tr>
<th>SIDS Integration Theme</th>
<th>Sub-themes/indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Risk governance</strong></td>
<td>1. Mention of risk governance activities in sector activities related to the Built and Natural environment, Social environment or Economic environment (See Chapter 4, Paper 1). See Chapter 5, Paper 2, for examples of excerpts chosen.</td>
</tr>
<tr>
<td><strong>activities incorporated</strong></td>
<td>2. Statements (implicitly and explicitly) about the risk governance processes (per the conceptual framework in Paper 1) in the visions, mandates, institutions (laws, norms, policies, networks) conventions, rules (formal and informal), and protocols. Reference to budgets (financial resources), technical and human resources, networks, relationships and ‘political will’ for risk governance.</td>
</tr>
<tr>
<td><strong>in development processes</strong></td>
<td></td>
</tr>
<tr>
<td><strong>2. Systemic approach</strong></td>
<td>Mention of how human and natural components of the system and interactions are accounted for in risk governance; as well as the external drivers and system responses, such as those related to coral ecosystems, development, livelihoods and risk. Additionally there is mention of development problems being addressed in connection with a description of the systems affected by specific hazards and feedback interactions with environmental, social and economic systems, in the near-term and long-term (see Paper 1, Chapter 4).</td>
</tr>
<tr>
<td><strong>3. Joined-up governance</strong></td>
<td>1. Mention of connections between legislation; purpose and vision statements of policies across sectors and systems for managing risk.</td>
</tr>
<tr>
<td><strong>and network approach</strong></td>
<td>2. Mention of mechanisms for sharing, operating and networking across levels at the national, regional and community level. Including mechanisms for cooperative funding across institutions.</td>
</tr>
<tr>
<td><strong>4. Risk Governance</strong></td>
<td>1. Indication of activities that correspond to risk governance type activities (Paper 1, chapter 4).</td>
</tr>
<tr>
<td><strong>process coverage;</strong></td>
<td></td>
</tr>
<tr>
<td>SIDS Integration Theme</td>
<td>Sub-themes/indicators</td>
</tr>
<tr>
<td>----------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Deliberation and Polycentricity</strong></td>
<td>2. Mention of mechanisms for inclusion and deliberation in the risk governance process (based on Renn's indicators (2008, p. 282-283)).Paper 2, Chapter 5.</td>
</tr>
<tr>
<td></td>
<td>3. Reference to polycentric features (see section 2.7.1).</td>
</tr>
<tr>
<td></td>
<td>4. Mention of Type 1 or Type 2 multi-level governance features (See section 2.7.1 and Chapter 5- Paper 2).</td>
</tr>
<tr>
<td><strong>5. Communication</strong></td>
<td>1. Reference is made to structures for communication of risk information- across different types of participants (such as scientific and non-scientific) or between DRR and CCA organisations.</td>
</tr>
<tr>
<td></td>
<td>2. Mention of communication mechanisms for sharing across different levels (national, regional, community) of organizations. Mention of sharing of different types and sources of information from different types of organisations.</td>
</tr>
<tr>
<td></td>
<td>3. Mention of structures such as knowledge sharing platforms; tools; and brokers. See Chapter 4- Paper 1.</td>
</tr>
</tbody>
</table>
The second method applied was an online survey which gathered data on the potential shown in practice by DRR and CCA institutional structures and processes for integrated risk governance. Surveys are one of the main research methods used in the social sciences (Donley, 2012). This method allowed statistical data to be gathered on the attributes, attitudes and actions of DRR and CCA risk governance participants using standardized questions (Buckingham and Saunders, 2004). Furthermore as it is often used to gather information on social networks for social network analysis (Borgatti et al., 2013). It was therefore used to gather data on potential for DRR and CCA risk governance exhibited by interconnections and interactions across structures and processes. The survey method was used because it was a highly cost effective way to gather the data needed and has been proven to be a perennial source of adequate information on networks.

Though the survey is often purported to give unbiased data, the thesis recognises that there may still be biases since people may not always report what they practice (Buckingham and Saunders, 2004). Furthermore how questions may be constructed to derive quantifiable measurements and how they may be interpreted may produce unreal or 'negotiated accounts of reality' (Buckingham and Saunders, 2004). To minimise some issues of bias therefore caution is taken in interpreting results (Buckingham and Saunders, 2004) and findings are triangulated with some of the findings from the qualitative study. Since the survey focused on day-to-day practice and not past behaviour and attitudes, errors associated with recall were avoided (Buckingham and Saunders, 2004). Whilst questionnaires often provide information on individuals (Buckingham and Saunders, 2004), as the unit of analysis in the study was ‘individual organizations’, consent forms were designed to ensure that those participating in the survey indicated that they were given permission to represent the views of the organization. The approach taken for data collection is now presented and is followed by a review of the social network analysis applied to the data collected.

3.9.2.1. DATA COLLECTION

Prior to the collection of the data, key decisions were made concerning the sampling method, compilation of the sample, the inclusion and exclusion criteria as well as the setting and design of the survey. Survey data were collected over the period February 2, 2015- May 8, 2015.
A. SAMPLING

The research focused on specific groups of persons who either had features or were associated with the circumstances that concerned the study. To this end, a purposeful or targeted sampling approach was taken (Patton, 1990, 2015; Suri, 2011). The application of this approach allowed for the purposeful inclusion of a wide range of participants with access to essential sources of information (Patton, 2015).

I. CONSTRUCTING THE SAMPLE

In applying the purposeful sampling technique (Patton, 2015) a list was constructed based on the researcher’s conceptual framework and insider knowledge of organisations that had roles to play in risk governance. Given the central government structure of the case study, much of the sample comprised of government agencies. The list was further enlarged based on input from the lead DRR agency (DEM). Based on DEM’s understanding of risk governance the sample was expanded to include all participants of the national emergency management system. Other participants were included by way of a snowball approach (Donley, 2012). In applying this approach, the survey asked persons to identify others who were not included in the list of participants that should participate in the study. This allowed for the SNA network of risk governance to be bounded. As the study focused on identifying the whole network of participants working at the macro-level of DRR and CCC risk governance in Barbados it was important to include as many participants as possible. In total 35 organisations were invited to participate in the survey and 20 participated (including the 5 core organisations interviewed at section 3.9.3 who answered the SNA questions only). Response/completion rate was 76%. See Table 3-8 for the list of participants to whom the survey was sent, and those that participated.
<table>
<thead>
<tr>
<th>Type of Organisation</th>
<th>Organisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market</td>
<td>1) Barbados Chamber of Commerce and Industry (BCC) 5) Barbados Light and Power (BLP) 3) General Insurance Association of Barbados (GIAB) 4) Barbados Association of Professional Engineers 5) Ministry of Finance</td>
</tr>
<tr>
<td>Social</td>
<td>5) Barbados Red Cross 6) Future Centre Trust</td>
</tr>
<tr>
<td>State (at the Intra Regional)</td>
<td>33) Caribbean Disaster Emergency Management Agency (Coordinating Unit), 34) Caribbean Institute for Meteorology And Hydrology University of the West Indies: Centre for Resource Management and Environmental Studies; Department of Computer Science, Mathematics and Physics</td>
</tr>
</tbody>
</table>

5 Bolded organisations were those whose network data was provided by the researcher.
II. INCLUSION AND EXCLUSION CRITERIA

Criteria were applied for participation in the study. These follow. Not all organisations who agreed to participate, participated. Neither was all questions answered by participants.

1. Inclusion
   a. Participants who were authorised to represent their organisations. Only one response was allowed per organisation.
   b. Participants who had a good understanding of their organisation’s climate related work.
   c. Broad sector representative organisations - 1) the building and natural environment sector - disaster management, building, environment, planning 2) social sector - water, health, social care and 3) economic sector - business, tourism, utilities, and economics. These organisations were considered to be leaders of the main sectors that the conceptual framework identified and not micro actors of the sector systems they represented.
   d. Organisations with a DRR or CCA risk governance role that supported regional, national or community level work in Barbados.
   e. Organisations from the four main groups that concerned the research, government and non-government experts, scientists, community groups, private sector.
   f. Participants who indicated that they were only working in disaster response or indicated that they were not doing climate related work were included but were not asked further questions.
   g. Incomplete and completed surveys since both provided useful information to the study.

2. Additional Inclusion Criteria for the SNA
   a. Five Core organisations were added that were not included in the online survey sample. The SNA survey was administered to them in person for convenience.
   b. Any organisation included by a participating respondent but not in the drop down list provided, with whom they shared information.
   c. Organisations that have a mandate for risk governance.

3. Exclusion
   a. Organisations working at the micro level of the system. For example the survey was sent to the ministry of tourism but not the Barbados Hotel and
Tourism Association or tour operators who may have roles in risk governance for the tourism sector but operate at a finer scale.

B. SURVEY DESIGN

The other key aspect of data collection was to ensure that the survey was designed appropriately. The design consisted of 17 main sections with on average 60 questions per survey lasting for approximately 1 hour. Up to 130 questions could be asked if an organisation indicated that they were working in all areas of risk governance. This however would be quite unusual given the specific nature of the expertise required for some risk governance processes. Nevertheless, in the case that this did occur, an in-person interview was used since the survey would be too long.

The survey ascertained facts about the ‘population’ of DRR and CCA risk governance practitioners, their attributes, perceptions and level of involvement in risk governance processes. The aim of the survey was to describe and not to find evidence for the ‘cause’. The survey had multiple purposes. It was designed around the conceptual framework that gave indicators of integration (Chapter 4, Paper 1). It gave information on the potential for integration being displayed in the risk governance networks in which organisations participated:

1) Which risk governance activities they were involved with?
2) Climate change considerations,
3) The organisations they shared or collaborated with and,
4) The characteristics of the sharing/ collaboration relationship - what was shared, the strength of the connection, and who was included or excluded.

In this regard, the survey had two main sections that were associated with two different designs. The first section addressed 1) and 2), and the second section was designed to address interconnections (3 and 4) that could be analysed through social network analysis and to give an overall view of the quality of the risk governance process and areas for improvement. Some SNA data was also derived from the survey questions in part one of the surveys on risk governance activities that organisations participated in (Appendix 8).

I. STRUCTURE

The survey followed a ‘structured’ format with options for comments at each stage. It provided drop down lists from which participants could provide their answers as well as a number of questions that allowed for ranking or scaled responses. Two open-ended questions were included on their specific roles and the kinds of information shared/generated and opportunities for making connections with development. This question
allowed for details and for verification of responses given in earlier sections of the survey on the work they were engaged with. Section 2 followed with a social network analysis design at the latter part of the survey. The theory informing the design of the survey questions is discussed in the subsequent section II. The full survey is given at Appendix 8.

Before the survey was administered it was pre-tested (Buckingham and Saunders, 2004) with two potential types of respondents - those familiar with climate related work and those that may not be heavily involved. This allowed adjustments to be made in order to ensure better clarity and to address the flow of questions.

II. THEORETICAL FRAMING OF THE SURVEY

Table 3-9 indicates how theory informed the questions of the survey. The entire survey is based on information related to the climate and weather related activities that are identified at the outset of the survey. The activities correspond with the processes of the risk governance framework reviewed at section 2.5.1. The term climate related work and climate change was used rather than the terms of disaster risk reduction and climate change adaptation in order to avoid terminology misunderstandings.

Research shows that differences in terminology for DRR and CCA mean nothing to communities who do not see the impacts of climate change or disasters of natural origin from a sectorial point of view but as mentioned at section 2.7 impacts are seen as interrelated with processes such as political, social, environmental and economic factors (Mercer, 2010). The use of this term was also informed by other surveys such from the Climate Just project (Climate Just, 2014b) that ask about climate change adaptation work using questions about climate related work and whether climate change was incorporated in this work. The categories of the activities for this climate related work pertained to the process of risk governance (Renn, 2008; Renn and Klinke, 2013). In total, five of the seven categories of the theoretical framework were asked about through 14 simplified expanded categories of the risk governance processes. For example, pre-estimation was captured under 3 categories. The category ‘other’ was applied to capture the other categories not mentioned. For example, no specific theme was offered in the survey for characterisation (process #3 in section 2) or monitoring the implementation of risk management initiatives (process #6 in section 2). Further questions in the survey were then linked to these key processes. A separate section on communication and inclusion principles as articulated by Renn, (2008) was included in later sections.
<table>
<thead>
<tr>
<th>Theoretical Framework Theme</th>
<th>Literature</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Risk governance main themes:</strong> Pre-estimation/ Framing; Interdisciplinary Estimation; Evaluation; Management, Communication (with respect to building awareness only).</td>
<td>The activities listed were based on definitions given by Renn, (2008) for each risk governance theme.</td>
</tr>
<tr>
<td><strong>Information:</strong> types of information and drivers</td>
<td>Options provided based on section 2.4.2.</td>
</tr>
<tr>
<td><strong>Importance of risk governance:</strong> in terms of budget (%) dedicated and reasons for doing risk governance</td>
<td>List of hazards of interest, based on section 1.2</td>
</tr>
<tr>
<td><strong>Hazards in risk governance</strong></td>
<td>Options provided based on section 2.4.2.</td>
</tr>
<tr>
<td><strong>Perceptions about participatory processes</strong></td>
<td>Options based on Renn's (2008, p. 282-283) indicators for deliberation (section 5.4.3.2)</td>
</tr>
<tr>
<td><strong>Inclusion and Communication</strong></td>
<td>List of participants generated from DEM National Emergency Management System list, researcher's knowledge of actors and snowball approach (section 3.9.2. A. I). Options provided based on section 2.5.2 and 2.8.1.</td>
</tr>
<tr>
<td><strong>The extent of climate change integration.</strong> This is measured by how climate change is addressed and how often it is addressed. The reasons for why climate change is not considered in risk governance are ascertained is also included.</td>
<td>Time used to measure importance based on section 1.1. Addressing climate change on a daily basis is limited in SIDS. Concerning Barbados per section 1.2 integration is not a policy objective. Considering climate change calls for adjustments to how risk is governed (see Chapter 4- Paper 1 including how vulnerability is addressed (see section 2.8)). Options suggested reflect some of the key barriers to DRR-CCA (section 2.7, Table 2-2).</td>
</tr>
<tr>
<td><strong>Resources:</strong> What can assist in better carrying out risk governance roles</td>
<td>Options provided are based on risk governance performance indicators. See section 2.4.1</td>
</tr>
<tr>
<td>Theoretical Framework Theme</td>
<td>Literature</td>
</tr>
<tr>
<td>-----------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Information sources and tools:</strong> Includes hindrances to using maps or mapping software (PSS); as well as hindrances to using risk information.</td>
<td>Options based on section 2.4.2 and section 2.7</td>
</tr>
<tr>
<td><strong>Levels of operation:</strong> Community, National or Regional, other</td>
<td>Based on multi-level approach in chapter 2, section 2.6; and Chapter 4, Paper 1.</td>
</tr>
</tbody>
</table>
III. SNA SURVEY DESIGN

Questions about the risk governance information sharing network were included towards the beginning and mainly at the end of the survey on what they were engaged with, who they shared with, what they shared, and the classification of the strength of their relationship whether information sharing or collaboration. From this data, two networks could be derived- the network for collaboration and the network for information sharing to which SNA metrics for inclusion, polycentricity and the degree of multi-layeredness operating could be applied (see section 3.9.2.3 on SNA; and Paper 2, Chapter 5). Some of these questions were based on a previous SNA survey by the Climate Just Project. Examples of the SNA questions are included in Table 3-10.

TABLE 3-10: SAMPLE OF SNA QUESTIONS FROM THE ONLINE SURVEY

<table>
<thead>
<tr>
<th>Section- Information Sharing and Your Organisation- Government</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question- Tell us about the MAIN kinds of information that your organization may share with the GOVERNMENT organisations listed below:</td>
</tr>
</tbody>
</table>

Non-network data was collected at earlier sections of the survey on attributes such as the level at which the organisation carried out its risk governance work (community, national and intra-regional), and the type of organisation (in terms of the kinds of services provided). This allowed for contextualising and comparisons in the data collected.

It is recognised that since the bulk of the SNA questions were at the end and there may have been fatigue (Borgatti et al., 2013). In order to minimise this and also to guard against recall error, a roster of all potential nodes was included in a matrix of close ended drop down box selection questions (Borgatti et al., 2013). These were arranged alphabetically and by category- government vs. non-government to help minimize fatigue. To facilitate the
inclusion of any missed organisations, an open line was included for adding additional persons not in the list. In total, a list of 24 organisations was provided which was later expanded to 35 organisations.

C. SETTING
With respect to the setting for administering the survey it was decided that an online survey/questionnaire afforded an easier and quicker way for the researcher to gather data (Donley, 2012). The emphasis was on getting data from as many organisations as possible to develop the social network for risk governance in the simplest and quickest manner. In this regard, the online format was deemed to be a better option than in person interviews. A secure and flexible online survey software tool, survey gizmo was chosen to design and administer the survey: https://www.surveygizmo.com/. Through the application of appropriate inclusion criteria (at section C) and survey design (see section E) the survey targeted the right participants. The online format afforded participants the opportunity of completing the survey at their own convenience and over whatever period of time was suitable to them.

Missing actors and their links, that may be associated with the possibility of lower response rates from the online survey than other methods such as in person surveys (Donley, 2012), can affect structural and analytical outcomes of the SNA (Kossinets, 2006; Borgatti et al., 2013). That is non-response can challenge the validity of the social network analysis. Non-response may be from a number of different sources, including refusal to participate or simply survey fatigue (Borgatti et al., 2013). To minimise this, the survey was followed up with other data to fill holes, as well as telephone calls, and some in person surveys.

3.9.2.2. SOCIAL NETWORK ANALYSIS
Social Network Analysis (SNA) is a mathematical approach that allows for a study and analysis of the 'structures of relationships' (Wasserman and Faust, 1994; Borgatti et al., 2013). This is done with networks and graph theory. SNA is often used in connection with other types of analysis to give a deeper understanding of relationships. Fundamentally, the network relationships may be observed in graphs of mathematical measures derived from network metrics of the relationships under observation (Borgatti et al., 2013). In this regard, networked structures are characterised by nodes and ties. Nodes may be organisations, individual actors, or things or even activities within the network; whereas ties also referred to as edges, or links may be relationships or interactions that connect them (Otte and Rousseau, 2002; Borgatti et al., 2013). SNA applications are numerous, consisting of assessments of various phenomena- social relations, flows of activities- infection, goods,
information, and co-occurrences (Borgatti et al., 2013). This thesis therefore applied it to understand the flows of information between organisations. It has also been applied to understand the strength of the ties of relationships between several actors and different groups of organisations (Wasserman and Faust, 1994; Scott, 2000). It was therefore applied in this study to look at the strength of ties between organisations and strength of the relationships with the risk governance processes. Further application of the SNA allowed for the identification of uniquely positioned or important organisations in the network (Wasserman and Faust, 1994). The underlying assumption is that the actor’s position in the network determines in part the challenges and opportunities that will be encountered. Hence if the position of the actor in the network can be identified then this could predict the outcomes in terms of access to information and the benefits or disadvantages that this may provide (Borgatti et al., 2013). It therefore seemed plausible that based on the position of the node or organisation in the risk governance network, advantages or disadvantages for integration could be derived. This was analysed at the nodal level and network level (Borgatti et al., 2013). A whole network design was applied (Borgatti et al., 2013) which was most applicable to understanding in total DRR and CCA risk governance organisation relationships and interactions. In this design, the set of ties between all pairs of nodes was the focus (Borgatti et al., 2013). In this study, the nodes were organisations or activities and the ties, information flows. The SNA offered a number of measures for understanding the relationships in the network. In this regard, social network metrics were determined for indicators of DRR-CCA such as multi-layeredness, polycentricity, and inclusiveness (discussed at section 2.5 and section 2.7). This had not been done previously. Further metrics were identified for other DRR-CCA risk governance features such as for collaboration and communication potential. These metrics built on previous SNA studies that look at social processes of governance such as collaboration (Luthe et al., 2012; Balsiger and Ingold, 2016; Horning et al., 2016), climate information sharing (Cunningham et al., 2016) and stakeholder involvement in hazard mitigation planning (Lyles, 2015). The following measures were identified: density, as well as a number of centrality measures and measures of interactions that would give useful information about the network and nodal (organisation) potential for integration. Each metric is now discussed in turn.

A. DENSITY METRIC

Density is ‘the number of ties in the network expressed as a proportion of the number of possible ties’ (Crossley et al., 2015, p. 12). The density depends on the group. The density of the network may give some indication of the joint action or adaptive capacity that is supported by the network since it is anticipated that the denser the network the higher the probability
for collaboration (Olsson et al., 2004). Whilst the use of density measures are best when used in a comparative way (Borgatti et al., 2013) this was beyond the scope of the study which focused on one case. The study's findings can provide a benchmark for future studies in SIDS since densities of small groups cannot be compared with densities of large groups (Borgatti, 2002).

B. DEGREE CENTRALITY METRIC

Besides density, degree centrality is another useful metric. The degree centrality is the comparison of the number of ties a node/organisation has compared to others. In this case, this is the number of organisations that an organisation either shares or receives information from. It is not related to position in the network but may be related to other variables. It was applied to identify the major and minor organisations receiving or sharing information in the network. These may suggest potential information rich decision-making hubs in the networks. Centrality may be an indicator of one feature of integration as it measures the direct relationships the individual is involved in (Balsiger and Ingold, 2016). Integration in networks applies to these direct relationships as well as an individual (in this case organisation) position in the overall network (Granovetter, 1992). The more deeply integrated that actor is in the network, the more central the actor is in a network of relationships (Ansell, 2003).

C. BETWEENNESS CENTRALITY METRIC

Another measure of centrality is 'betweenness'. It gives information about the advantage of the node by virtue of its position (Borgatti et al., 2013). This measure is important to the research since features of polycentricity and inclusion (integration features) relate to the position of organisations with respect to each other and the activities that they are involved in. Betweenness centrality (Freeman, 1979) calculates centrality as how often a given node falls along the shortest path between two other nodes (Borgatti, et.al., 2013 p. 174). More specifically, it is calculated for a given focal node by computing for each pair of nodes other than the focal node, what proportion of all the shortest paths from one to the other pass through the focal node' (Borgatti et al., 2013 p. 174 ). It is measured on a scale of 0-1 where zero represents that it is never along the shortest path of any two nodes or organisations. This would be the case of isolates. It is one (1) when the node lies along 'every shortest path' between every pair of other nodes. In this case, this measure often indicates nodes that have the potential to control the network or that may be essential bridges to others. If these
‘bridges’ should be eliminated from the network then others would be cut out. From a DRR-CCA perspective this feature was therefore applied to help identify those entities that are highly essential for social processes such as collective action (Vignola et al., 2013). These ‘bridging’ actors or ‘brokers’ could also be interpreted as the influence that an actor has on others based on their unique position (Brandes, 2001). In this research, it was applied to help identify entities that are highly important for establishing polycentric centres. High betweenness may not however provide insight into characteristics of those organisations being connected. Engaging with diverse actors is necessary as well as at different scales for adaptive governance. Engagement of diverse entities refers to the inclusive feature and across different scales refers to the integrated feature of multi-layeredness. To capture these characteristics of the network another measure was necessary—sub groups. This diversity was investigated at the level of the interactions with other groups which also may be an indicator of the potential for the integrated feature, ‘a systemic approach’ or innovation brokers (Ernstson et al., 2010).

D. SUB-GROUPS

As the work was concerned with the potential features of integration, it seemed that a SNA could point to features of polycentricity of the network through its metrics for identifying subgroups and the characteristics of the groups. ‘Sub groups are groups of actors that interact with each other to the extent that they could be considered a separate entity’ (Borgatti et al., 2013 p. 181). Sub-groups tend to share standards and frequently mutual objectives and ideals (Borgatti et al., 2013). Sub-groups would exhibit the potential for integration if they were associated with development mandates (macro-systems), or if they included organisations at different levels. The SNA was also applied to identify who may be important brokers between groups (Borgatti et al., 2013). A number of sub-group measures were available in the SNA. In this study, assessments were made for cliques. A clique is defined as, ‘a subset of actors in which every actor is adjacent to every other actor in the subset and it is impossible to add more actors to the clique without violating this condition’. In reality cliques can be overlapping, one can be a member of more than one group. However, for this study, overlapping was condensed by reducing the overlapping possible and identification through hierarchical cluster analysis and consideration of clique participation.
E. TWO MODAL ANALYSIS

A visual approach was taken to look for interactions and patterns between organisations and the activities in which they participated. The data was analysed directly as a bipartite or two modal graph (Borgatti et al., 2013), created from the connections between organisations and the activities they indicated. See Chapter 5, Paper 2. Data was treated as one directional and patterns were analysed based on the mathematical UCINET projection of the graph. In order to apply the appropriate SNA analysis it was necessary to convert the survey data into a format for SNA. This is now discussed.

3.9.2.3. SNA DATA MANAGEMENT FOR ANALYSIS

A. ANALYSIS SOFTWARE

UCINET, which is a software dedicated to social network analysis was used to analyse the network features and NetDraw (Borgatti, 2002) was used to generate graphs of the social network of organisations involved in risk governance activities, and their communication networks. In this regard, the level of polycentricity, multi-layeredness, inclusiveness, and collaboration, captured in the survey data collected was analysed through the network analytical approach.

B. CODING

Text data concerning the options selected from the drop down matrix was converted to numbers, which is a format that UCINET could interpret. A codebook was developed and data on each listed risk governance activity including other categories such as 'nothing', 'collecting data', ‘responding to emergencies' and ‘rebuilding and recovery'. This was necessary for capturing the risk governance processes and wider disaster management cycle. Coding was done using an excel spread sheet using a matrix format to convert the data to a one mode format where the same list of organisations was in the columns as those in the rows. In total 35 organisations were also coded. Information on relationships was made binary- that is, whether there was a relationship (given the score 1) or not (given the score 0). Other data was coded and collapsed for less groups and the value data provided was maintained- such as the data on the type of information shared and the strength of the relationship (irregular, periodic, frequent). Matrices were developed for collaboration, information sharing, what I share. See Figure 3-3 for an example on how data on what I share was input to the UCINET. To avoid errors of omission or commission that could lead to misspecifications of the model
(Borgatti et al., 2013) the data was checked and re-checked to ensure that correct codes were assigned.

<table>
<thead>
<tr>
<th>Survey Answer Options (What I share)</th>
<th>Numerical Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nothing</td>
<td>0</td>
</tr>
<tr>
<td>Technical expertise</td>
<td>1</td>
</tr>
<tr>
<td>Case studies</td>
<td>2</td>
</tr>
<tr>
<td>Data</td>
<td>3</td>
</tr>
<tr>
<td>Analysis/Assessments</td>
<td>4</td>
</tr>
<tr>
<td>Policies/legislation</td>
<td>5</td>
</tr>
<tr>
<td>Ideas</td>
<td>6</td>
</tr>
<tr>
<td>Work plans</td>
<td>7</td>
</tr>
<tr>
<td>Experience</td>
<td>8</td>
</tr>
<tr>
<td>Best practice</td>
<td>9</td>
</tr>
<tr>
<td>Technical guidance</td>
<td>10</td>
</tr>
<tr>
<td>Other</td>
<td>11</td>
</tr>
</tbody>
</table>

**FIGURE 3.3: UCINET WHAT I SHARE MATRIX**
A two modal matrix was developed for analysing the relationships between organisations and activities. These matrices were then transferred into UCINET for analysis. Attribute data was coded and imported on the level of organization (national, regional, community). The network was understood to represent for the most part a whole network of organisations that were identified to be communicating information related to DRR and CCA risk governance in Barbados.

C. DEALING WITH MISSING DATA

Notwithstanding efforts to minimise missing data, there was still missing data. Statistics that are affected by missing data were not calculated (Kossinets, 2006). Research shows that the degree centrality measure is the most robust to study error under different sampling conditions (Borgatti et al., 2013) such that there could be certainty that the values here would not be affected by missing data. A number of methods were considered, as established in literature, to fill the data gaps but were not utilised since based on the researcher’s insider knowledge of the existing network and positionality these methods would have given an inaccurate reflection of the relationships. For example, one typical way of filling gaps that is to used is to reciprocate the information supplied from those who named the organisation to establish if there was a tie or not- reciprocal approach (Borgatti et al., 2013). However, this was not applicable since it was known that for many organisations that although they receive information, the inverse is not the same- they do not share with those providing. In addition in some cases the data was valued data (for example, what was shared) so that a reciprocal approach could not be applied. Another way could have been to eliminate the nodes with missing information and to treat them as missing data. This was not done since it would eliminate data that was gathered about them from other organisations. Alternatively the nodes where data was missing could have been treated as zeros however since the researcher had some information on these nodes this was not done. Missing data were input based on the researcher’s knowledge of the network together with a method whereby similar relationship values were assigned based on values for similar organisations where information was known- conditional mean method. For instance, if the organization that had missing data is an environmental NGO, then it was assigned attributes values equal to the mean values obtained from other environmental NGOs that are part of the network (Berardo, 2014). According to Huisman (2009), the stability of most network measures is not threatened with a rate of missing data as low as the one I obtained (24%). For low to medium proportions of missing data (up to 40% missing data) in undirected networks, imputation by reconstruction is quite capable of correcting the effects of non-response (Huisman, 2009).
As the study focused on a whole network of actors that were assumed to have a role in risk governance, it was possible to have actors included who were not named by others. These are called isolates and since the information about them was important, they were maintained in the network and not deleted to emphasise the point that they should be a part of the network but were not.

### 3.10. STAGE 3- ANALYSIS OF CHALLENGES TO DRR-CCA RISK GOVERNANCE

Stage 3 of the research focused on the analysis of challenges to DRR-CCA integration. Data for this objective was gathered in part from the SNA analysis and the document analysis in the former stage-2 (section 3.9). In addition to this, data was collected from in-depth interviews, which were analysed using thematic analysis. Using these three methods provided a deeper perspective on the potential challenges. See Table 3-11. Data at stage 2 reflected what was documented and the perspectives of a wide group of participants on challenges as well as gaps in their communication networks. Together with additional data from interviews with organisations considered to be at the core of network, this gave a more complete perspective on challenges and why they occurred.

<table>
<thead>
<tr>
<th><strong>TABLE 3-11: METHODS OVERVIEW FOR STAGE 3</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Research Objective 3:</strong> To analyse the challenges to successful DRR-CCA integration in SIDS from a Barbados perspective</td>
</tr>
<tr>
<td><strong>Research Questions:</strong></td>
</tr>
<tr>
<td>• What are the DRR-CCA risk governance challenges in Barbados, as a particular SIDS context?</td>
</tr>
<tr>
<td>• Why do DRR and CCA risk governance challenges occur?</td>
</tr>
<tr>
<td>• How does islandness influence them (DRR and CCA challenges)?</td>
</tr>
<tr>
<td><strong>Research stages</strong></td>
</tr>
<tr>
<td>Investigate DRR-CCA challenges to risk governance.</td>
</tr>
<tr>
<td>Investigate why DRR and CCA risk governance challenges occur. Particularly why do structures and</td>
</tr>
</tbody>
</table>
Examine the influence of islandness on DRR-CCA risk governance challenges identified. | Thematic Analysis | Interview transcripts

3.10.1. THEMATIC ANALYSIS

Thematic analysis may be defined as a method for identifying, analysing and reporting patterns (themes) within data (Boyatzis, 1998, p. 79). As mentioned it was applied together with social network analysis and document analysis which is typical for thematic analysis which is often carried out with other methods (Braun and Clarke, 2006) though it can also be a standalone method. This method was selected as a suitable method not only because it is a flexible and simple approach for identifying themes but because it aims to understand or uncover to some extent the constructs of the problem (Braun and Clarke, 2006). It was therefore deemed suitable for answering the questions of what the challenges were but more importantly why do DRR and CCA risk governance structures and processes occur and how does islandness influence them?

Whilst there is no agreement on how thematic analysis may be carried out (Attride-Stirling, 2001), Braun and Clarke (2006) provide a useful six phase approach that was applied for this thesis. It includes: 1) familiarisation with data, 2) generating initial codes, 3) searching for themes, 4) reviewing themes, 5) defining themes, and finally 6) producing the report. I now review how data was collected for the thematic analysis after which how these 6 steps were applied for the analysis is reviewed.

3.10.2. DATA COLLECTION

In this section the interview method is reviewed and the method of analysis which was thematic analysis.
3.10.2.1. INTERVIEWS

The Interview is one of the most commonly used methods to collect data in qualitative research (Flick, 2009). Interviews are useful for understanding the processes, connections and observations of practice. In this regard, it was used to gather details on the challenges that persisted in the DRR and CCA risk governance processes and why they occurred. The interviews covered the same topics as the surveys in order to facilitate triangulation.

Interviews are viewed as social encounters implying some objective truth as well as rational with respect to story-telling of reality that ever changes (Holstein and Gubrium, 2004). Rather than a standard interview approach, active interviewing (Holstein and Gubrium, 2004) was applied in order to capture the various contexts under which decisions are made. This is a departure from the traditional interview that sets out to be totally objective though in reality we ‘cannot lift the results of interviews out of the contexts in which they were gathered’ (Fontana and Frey, 2005, p.716). In connection with the interpretivist approach to the research (discussed in section 3.4), the researcher applied the interview in the context that it was a ‘meaning making project’ (Holstein and Gubrium, 2004, p. 150) where the interview was unavoidably interactional and constructive- that is active (Holstein and Gubrium, 2004). From this perspective both interviewer and respondent work together to produce the data (Fontana, 1994) rather than the common interpretation that the interview is a one way means of obtaining knowledge. While it may seem that this may offer some contamination to the data received, rather, the view allows for recognition of the construction process- since interview data are the result of interpretive practice by the interviewer and interviewee this recognition calls for a focus rather on how the interview process unfolds. The emphasis rather was on how the interview process produced useful information about the phenomenon of interest and not whether it was contaminated (Holstein and Gubrium, 2004). This opened a wider array of complexity –how, where, when and by whom experiential data was conveyed and to what end (Holstein and Gubrium, 2004). Interviews were held face to face to allow for better engagement and reading into non-verbal behaviour and for establishing rapport that wouldn’t be possible with an electronic interviewing (Markham, 1998) or the survey approach applied at stage 2.

A. SAMPLING

A purposeful sampling approach was applied whereby individuals were selected for interviews that could give a rich description of the phenomena under study (Patton, 2015),
which is potential challenges to integrating DRR-CCA. It was therefore not necessary to have large numbers of interviews whilst key participants could be strategically identified (Patton, 2015). Whilst the survey criteria (at section 3.9.2.1) included all persons involved in risk governance at the macro-level, the interviews only included participants who were at the core of the risk governance process. This is reflected in the following list of inclusion and exclusion criteria applied.

I. INCLUSION CRITERIA
   a. National and regional level actors identified as working at the core of the risk governance process.
   b. High level and very high level decision makers; and technocrats involved in spatial decision support to DRR and CCA risk governance processes.

II. EXCLUSION CRITERIA
   c. Organisations not at the core of the risk governance process.

Specifically interviews were convened with the lead organisation for disaster management, and the lead for climate change. The main entities for development and coastal planning were also included as well as the leads for scientific investigation and flood control which was identified as a key hazard (in section 1.2). Data were gathered at the highest decision-making level possible- ministers, permanent secretaries, heads of departments, as well as at the technocrat level (See Appendix 3). In total 15 interviews were conducted. The way in which the researcher gained access to these participants was discussed at section 3.7.1.

B. SETTING

Interviews were conducted in a private office space environment. Rapport was established and interviewees were encouraged to be as frank as possible. The fact that the researcher was a Barbadian interviewing Barbadians (same culture) and a former public servant (similar experiences) helped establish rapport. There were no perceived gender biases. The researcher dressed in similar attire to interviewees- office attire to help establish rapport and to maintain a professional approach to the interview (Steinar, 2008). Prior to conducting the face-to-face interviews however, in order to facilitate methodological rigour in the data collection process, informed by the research design in particular, an interview guide was prepared. Field notes were also used. These activities are further discussed below.
C. INTERVIEW GUIDE

The use of the guide helped to ensure interviews were conducted appropriately and that the questions were within the research context (Flick, 2009). I now review the structure of the interviews and the literature that informed their design.

I. STRUCTURE AND THEORETICAL FRAMING OF THE INTERVIEW GUIDES

The guide consisted of semi-structured questions. As was the case of the survey, the topics covered in the interview guide were based on the risk governance conceptual framework (section 2.5 and Chapter 4) and in the context of flooding particularly. However, the guide provided questions for more details to be explored than was covered in the survey. Three different guides were applied. The first was designed for heads of departments and provided an overall view of the agency's role- see Appendix 9 for the interview guide. The second type of guide (Appendix 10) was used to interview technical staff as a follow on from the interview with the head of department, with more questions about the details of the process that the organisation specialised in it. It used a scenario as the starting point for the interview for specific discussion on details of the process. The third interview guide (Appendix 11) was designed with questions for very high-level decision makers such as ministers or permanent secretaries. It focused on their role in decision-making, and prospects for integration including their views on how spatial tools could help. A scenario approach was also used for the very high-level interviews, together with the use of physical maps to aid discussion and reflection on recent disasters. Questions focused on the 'how' of the processes in order to gain a description of the DRR and CCA risk governance experience from different decision-making perspectives, with the aim of the researcher evaluating the why (Steinar, 2008). Table 3-12 provides a summary of the literature that informed the questions asked in the interviews.
### TABLE 3-12: INTERVIEW QUESTIONS AND THEORETICAL CONNECTIONS

<table>
<thead>
<tr>
<th>Interview Themes</th>
<th>Guide / Literature</th>
<th>Head of Department</th>
<th>Technical Staff</th>
<th>Minister/ Permanent Secretary</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Risk governance roles and drivers for action</strong></td>
<td>Based on section 2.5 (roles, context and drivers). Also section 2.7.1.</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td><strong>The process, information, tools, quality, usage, improvements, and climate change adjustments</strong></td>
<td>Based on section 2.5, and 2.8.1</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td><strong>Overarching Framework, tools and spatial processes</strong></td>
<td>Based on section 2.5. and 2.8</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td><strong>Stakeholder interactions, sharing, roles, rules and inclusion</strong></td>
<td>Based on section 2.5 and Chapter 4. Also survey theory in Table 3-9, section 3.9.2.1.</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td><strong>Potential for integration, coordination and improvement</strong></td>
<td>Based on section 2.7 potential and barriers to DRR-CCA.</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>
D. CONDUCTING THE INTERVIEW

The interview schedule sought to ask specific but simple questions. The guide was piloted and adjusted for clarity (Steinar, 2008). The guides began with the context setting or briefing on the purpose of the interview (Steinar, 2008). The interview guide was designed with probing questions (Gillham, 2005), which allowed the researcher to follow up on pointers raised, make connections, and to clarify to ensure that quality data was generated (Gillham, 2005; Steinar, 2007). Although the interview guide was useful in providing structure for the interview, the order for the interview was not rigidly followed. Conducive to good interview practice (Steinar, 2008) the interview was allowed to flow smoothly to allow participants to give their risk governance experience. Throughout the interview the researcher guided accordingly, reflected (restating interviewee responses as a means of building on what was said) and focused the interview (Gillham, 2005) to ensure the key sections of the interview were addressed (Flick, 2009). This departure was acceptable since the interview was seen as a speech event of a jointly produced discourse (Mishler, 1986; Holstein and Gubrium, 2004; Steinar, 2007). This was in line with the research design, particularly the principles of the interpretivist paradigm (section 3.4). This approach allowed also for interviewees to establish a comfortable point from where to begin the interview. In the case of some high level interviewees they preferred to start taking about the topic and to be guided from there. This was allowed recognising the researcher only truly gains access to data when they recognise the communication rules of the interviewee (interpretivist paradigm)- this mode of questioning also was adequate for reaching the aims of the study (Hoffmann-Riem, 1980 in Trinczek, 2009). The wording of some questions was changed based on the flow of the interview since importance was fixed on the meaning of the question and not the wording (Holstein and Gubrium, 2004). Furthermore, quality standards were followed to ensure that though wording was changed that the new wording did not change the meaning of the question. The guide also helped the interview to stay on course and to avoid questions and responses that were fitted to the developing discourse (Mishler, 1986). Conclusion of the interview was achieved with a period of debriefing to allow for anything additional to be added by the interviewee. This was then followed by a period of reflection (Steinar, 2008).

E. TRANSCRIPTION AND TRANSLATION

All interviews were recorded in accordance with requirements for proper interpretation (Mishler, 1986). Fifteen transcripts were prepared from seven institutions. They were systematically transcribed verbatim by the researcher to capture adequate descriptions of the process for the subsequent stage of coding, analysis and interpretation (Mishler, 1986).
Transcription allowed overall for enhancement of the data analysis process (McLellan-Lemal et al., 2003; Braun and Clarke, 2006). This is because questions and the interviewer summaries would not have been sufficient to adequately represent what was said. Better understanding of what was said would help to begin to answer what they meant (Mishler, 1986). Mainly lexical features were transcribed as well as non-lexical expressions (Mishler, 1986) since at times persons reverted to the use of Barbadian dialect terms of emphasis which communicated deeper meanings (see section 3.7.1 on positionality).

3.10.3. ANALYSIS

Thematic analysis was applied to the transcripts derived from the interviews, using a slightly modified version of the 6 step process introduced at section 3.10.1- 1) familiarisation with data, 2) generating initial codes, 3) searching for themes, 4) reviewing themes, 5) defining themes, and finally 6) producing the report (Braun and Clarke, 2006). Modifications were based on the pragmatic design of the research discussed in section 3.4 that allowed for flexibility in the application of the steps in order to answer the research questions in the most suitable way. In the following section, I discuss how the theoretical approach influenced how the analysis was undertaken; thereafter details on how each step of the thematic analysis was applied is presented.

3.10.3.1. THEMATIC ANALYSIS: DEDUCTIVE AND INDUCTIVE

The theoretical paradigm for this research allowed for both a deductive, top down approach, as well as an interpretivist, bottom up approach to be applied to the analysis- that is a pragmatic approach. The thematic approach fit with the pragmatic paradigm for the study discussed at section 3.4. The deductive approach was applied to search for preconceived themes based on the conceptual risk governance framework at stage 1 that was developed from the literature (See Paper 1, Chapter 4). This was then followed by an inductive thematic approach for the identification of themes (Braun and Clarke, 2006). The inductive approach allowed for a bottom up approach by which there could be strong linking between the data and themes identified in the literature. This approach seemed to be more suitable for addressing the need to understand the issues overall and to let the data 'speak'. In this regard, the final themes identified did not reflect specifically the questions asked or the risk governance conceptual framework categories. The thematic analysis applied focused on surface meanings of the patterns (semantic) rather than underlying philosophies, suppositions, and conceptualizations and beliefs that may be informing surface meanings (Braun and Clarke, 2006). To some degree however, it looked for underlying meanings that
may have been related to islandness and smallness in order to understand and interpret why current processes operated the way that they did.

3.10.3.2. APPLYING THE THEMATIC ANALYSIS SIX STEP PROCESS

Further details on each of these steps are given in Table 3-13. The major modification was that both a deductive approach and inductive approach were applied to the analysis. The deductive approach was used in the first instance for phases 1-3; and the inductive approach was applied in as second stage that used data that was pre-analysed from the deductive stage. For both phases transcripts were imported into Nvivo (qualitative data analysis software), which was used as a database tool to assist in the assembling of the data, note taking during the analytical process, systematised coding around themes, schematic development and overall data reduction.

### Table 3-13: Phases of Thematic Analysis from Braun and Clarke (2006), p. 87

<table>
<thead>
<tr>
<th>Phases</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Familiarising yourself with your data</td>
<td>Transcribing data if (necessary), reading and re-reading the data, noting down initial ideas.</td>
</tr>
<tr>
<td>2. Generating initial codes</td>
<td>Coding interesting features of the data in a systematic fashion across the entire data set, collating data relevant to each code</td>
</tr>
<tr>
<td>3. Searching for themes</td>
<td>Collating the codes into potential theme, gathering all data relevant to each potential themes</td>
</tr>
<tr>
<td>4. Reviewing themes</td>
<td>Checking if the themes work in relation to the coded extracts (Level 1) and the entire data (Level 2), generating a thematic 'map' of the analysis</td>
</tr>
<tr>
<td>5. Defining and naming themes</td>
<td>On-going analysis to refine the specifics of each theme, and the overall story the analysis tells, generating clear definitions and names for each theme</td>
</tr>
<tr>
<td>6. Producing the report</td>
<td>The final opportunity for analysis. Selection of vivid compelling extract examples, final analysis of selected extracts, relating back of the analysis to the research question and literature, producing a scholarly report of the analysis</td>
</tr>
</tbody>
</table>
A. FIRST LEVEL OF THEMATIC ANALYSIS- DEDUCTIVE

In the first phase of the analysis, in order to familiarise myself with the data, interview transcripts were read and re-read electronically and initial ideas documented. Thereafter in order to generate initial codes (phase 2) rather than consulting the data, the step was adjusted to pre-define the themes based on the literature and the conceptual framework. The same themes (and associated literature) that were used in the design of the interview schedule were used to guide the coding process. See Table 3-12 in section 3.10.2.1.c. To facilitate coding each of these themes were broken into 10 subthemes. To ensure that codes were systematically assigned these sub-themes were defined by key indicators based on the literature associated with the theme. See Table 3-14 for an overview of how codes were assigned.

**TABLE 3-14: SUMMARY OF INITIAL DEDUCTIVE CODES**

<table>
<thead>
<tr>
<th>Theme</th>
<th>Indicators <em>(Reference to...)</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Accessing information</td>
<td>Accessing information, building awareness, data collection, data sharing, research, and the state of hazard information</td>
</tr>
<tr>
<td>2. Communication and Collaboration</td>
<td>Communication flows, roles, barriers, and opportunities</td>
</tr>
<tr>
<td>3. Basis for Participation</td>
<td>Reasons for doing risk governance work including partnerships</td>
</tr>
<tr>
<td>4. Climate Change</td>
<td>Addressing climate change and perceptions about climate change</td>
</tr>
<tr>
<td>5. Integration</td>
<td>Processes, approaches, arrangements, institutions, barriers, and contexts for integration</td>
</tr>
<tr>
<td>6. Resources for risk governance</td>
<td>Capacity building, regional or external inputs, policy and legislation</td>
</tr>
<tr>
<td>7. Responding to Emergencies</td>
<td>Response activities and preparation activities for better response</td>
</tr>
<tr>
<td>8. Risk frameworks</td>
<td><strong>At the Process level</strong>: Assessing perceptions and risks, Enforcement, Identifying risks for concern, Identifying vulnerability, Making judgements, Monitoring and early warning, Risk management projects, Setting out procedures for assessments. <strong>At the Macro Level</strong>: Policies and Frameworks and Sustainable development</td>
</tr>
<tr>
<td>9. Smallness issues</td>
<td>In terms of geographic area, work force, external pressures</td>
</tr>
<tr>
<td>10. Tools</td>
<td>Tools for risk governance, spatial tools e.g. GIS</td>
</tr>
</tbody>
</table>
Subsequent to the initial coding in phase 2, a codebook was developed and data was assigned to initial themes identified at phase 2 (searching for themes- phase 3). During this phase, transcripts were read on a computer; sentences that reflected the theme were highlighted and assigned to the theme electronically. This was done for one transcript at a time and then subsequent coding was done across all transcripts to look for similar codes, patterns and variations. Table 3-15 gives an example of the how initial codes were applied to transcript extracts for ‘Collaboration’. It is notable that one extract could have more than one code.

<table>
<thead>
<tr>
<th>Code</th>
<th>Extract</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collaboration/ Basis for Participation</td>
<td>‘….As opposed to a scenario where you have separate agencies that report to- how we operate- that report to a Permanent Secretary, we collaborate with each other to varying degrees but that collaboration between coastal and EPD or between coastal and NCC is dependent on the nature of what activity is going on at any particular time as opposed to deliberate and consistent efforts to meet, discuss, current on-going and future issues towards and objective of trying to do what we do better. You see what I’m saying?’ (FH, CZMU)</td>
</tr>
<tr>
<td></td>
<td>‘Well I think that it would have to be inter-ministerial because I may be concerned about hazards- about with fire, the potential impact that it would have on fire officers. Environment would be concerned or should be concerned about the potential impact on people who live around the area. Tourism may be concerned about the potential impact on the coastline etc. So it really has to be an inter-ministerial look at it and I’m not sure if we have.’ (AB, MOHA)</td>
</tr>
</tbody>
</table>
B. SECOND LEVEL OF THEMATIC ANALYSIS - INDUCTIVE

Using the data generated from the first level of analysis (deductive strategy), a second level of thematic analysis was applied using an inductive approach for the determination of themes within these themes. Each of these 10 thematically derived cases were read and re-read to identify emerging ideas for themes (Familiarising yourself with the data (Phase 1)). For phase 2 (Generating Initial Codes), initially 45 potential themes were coded for across the entire data set with special attention to coding with the surrounding context of extracts (Bryman, 2001). Extracts received multiple codes where applicable. According to phase 3, analysis focused on identifying themes. Different codes and relevant coded data extracts were sorted into identified themes. This resulted in 19 themes initially with associated sub-themes. See Table 3-16. During this phase, notes were taken continuously.

<table>
<thead>
<tr>
<th>TABLE 3-16: INITIAL THEMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Basis for participation</td>
</tr>
<tr>
<td>2. Communicating risk</td>
</tr>
<tr>
<td>3. Dealing with uncertainties</td>
</tr>
<tr>
<td>4. Enforcement</td>
</tr>
<tr>
<td>5. False positive risk understanding</td>
</tr>
<tr>
<td>6. Frameworks for or supporting risk management</td>
</tr>
<tr>
<td>7. GIS tools status and drivers</td>
</tr>
<tr>
<td>8. Impediments of a poor information base</td>
</tr>
<tr>
<td>9. Information seeking</td>
</tr>
<tr>
<td>10. Integration</td>
</tr>
<tr>
<td>11. Island methodologies and climate change</td>
</tr>
<tr>
<td>12. Making connections</td>
</tr>
<tr>
<td>13. Model Data inputs</td>
</tr>
<tr>
<td>14. Network Information</td>
</tr>
<tr>
<td>15. Preparedness and response dilemma</td>
</tr>
<tr>
<td>16. Roles and expectations mismatch</td>
</tr>
<tr>
<td>17. Roles of regional agencies</td>
</tr>
<tr>
<td>18. Scales of information needs</td>
</tr>
<tr>
<td>19. Social silence</td>
</tr>
</tbody>
</table>
These themes were further refined into six themes (Figure 3-4). These were, 1) Institutional and Data management *in-cohesion*, 2) Missing climate change (CC) and disaster risk reduction (DRR) connections, 3) low spread of DRR at the national level, 4) Delivering the Mandate, 5) Risk as a Side Issue and 6) Smallness Negatives.

**Figure 3-4: Initial Candidate Themes**

During phase four (reviewing themes), themes were further refined based on the data that was available to support them across the entire data set and the diversity from others. Others were collapsed and others separated. This step was repeated for each transcript, looking for patterns of those that were consistent, and those, which varied across participant organisations as well as across levels of decision-making. All codes were collated into these
themes. It included developing a thematic map. In this stage, linked candidate themes were identified and defined. Themes that were too diverse for analysis were discarded (Braun and Clarke, 2006). New themes were also created. See Figure 3-5 for refined themes - six broad themes were determined: cohesion issues, missing climate change and DRR connections, DRR in transition, smallness negatives, risk a side issue and making sense of risk.

Following on from reviewing the themes, themes were named per phase five (naming themes) and the story identified with respect to how the themes fit into the broader overall 'story' about the data, in relation to the research questions, with particular attention to minimising overlap between themes. Two broad themes were identified- 'Disconnections' and 'Adjusting Mind-sets'. In the final phase of analysis (phase six- producing the report), themes underwent further analysis, particularly to relate back to the questions on potential, challenges and smallness peculiarities (See Figure 3-6). They were interpreted based on experience and literature with comparison to survey and document findings at the subsequent stages of the research. In the subsequent chapters, I present the findings, which are papers, related to each of the research objectives.
FIGURE 3-6: STORY THEMES

- Disconnections
  - Missing connections
  - Cohesion issues
  - Disaster Risk Reduction in Transition
- Adjusting Mindsets
  - Smallness Negatives
  - Risk a Side Issue
  - Making sense of risk
CHAPTER 4. PAPER 1: A CONCEPTUAL FRAMEWORK FOR INTEGRATED RISK GOVERNANCE OF DISASTER RISK REDUCTION AND CLIMATE CHANGE ADAPTATION IN SMALL ISLAND DEVELOPING STATES

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ABSTRACT

Climate-related disasters continue to result in significant negative impacts in developed and developing countries. In the case of Small Island Developing States (SIDS), impacts from both current and future climate related extremes may threaten their very existence. This paper focuses on integrating two processes- Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA) (DRR-CCA) to address the potential SIDS crisis. It examines the novel concept of applying a risk governance framework for DRR-CCA in the case of SIDS. To do this, four critical reviews were undertaken. The first, examined SIDS features and DRR-CCA requirements for integration. The second reviewed the state of art of DRR and CCA integration. Based on the outputs of these reviews, a leading DRR-CCA risk governance framework was critically evaluated for application in SIDS. The study concludes with a fourth review that identified the possible mechanisms to address gaps that would make the framework applicable for SIDS. Finally, an Enhanced Adaptive Risk Governance (EARG) framework is drawn up. The EARG incorporates four features not previously found in overarching risk governance frameworks as necessary for SIDS. These are: 1) adaptive capacity in the risk estimation stage, 2) a core systemic approach, which is supported by, 3) a joined-up governance approach, and 4) a development approach to risk governance. In fact, an adapted DRR approach that integrated CCA in DRR, seemed to be the most rational for
SIDS, though this is not the most widely accepted approach for DRR-CCA. EARG promises enormous benefits and novel innovative approaches that require further examination and testing for rapid adoption in SIDS to avoid flawed and devastating pathways to addressing their climate crisis.

**Keywords** - integrating; disaster risk reduction; climate change adaptation; risk governance; small island developing states (SIDS)
4.1. INTRODUCTION

The year 2004 was a watershed year for the Caribbean region in disaster risk reduction. That year a series of tropical systems and hurricanes, affected multiple Caribbean Small Island Developing States (SIDS) including Haiti, the Bahamas, Grenada, Cayman Islands and Jamaica. With a death toll of 6000 in Haiti alone and US$ 6 billion dollars in damages there was a clarion call for concrete action to build resilience against the ‘inevitable hazards’ (CDERA, 2007 p.35). Moreover, the grave role of development choices in the manufacture of disaster was evident. In the case of Grenada, which was battered that year by ‘Hurricane Ivan’, one of the most catastrophic hurricanes to make landfall in the Caribbean region, a combination of development deficiencies including, limited diversification of the economy, weak institutions, as well as poor building practices have been associated with much of the devastation experienced (OECS (Organisation of Eastern Caribbean States), 2004). Up to 90% of the housing stock in Grenada was damaged or destroyed, and losses extended to the equivalent of more than 200% of its GDP (OECS (Organisation of Eastern Caribbean States), 2004). While the most recent Human Development Report, 2016, indicates that most SIDS are above the medium development threshold (UNDP, 2015), their extensive vulnerability, and their high exposure to natural threats, mean that disasters can quickly erode their development gains. DRR-CCA risk governance could provide a framework for minimising SIDS vulnerability to risk.

It is further expected that given current development trends, the worst disasters are yet to come (UNISDR, 2015a). The SIDS group as a whole, inclusive of the Caribbean, is expected to loose on average, up to 20 times more of their capital stock each year from disasters than regions such as Europe and Central Asia (UNISDR, 2015a). Whilst disasters may be costlier in developed countries (UNISDR, 2015a), SIDS lack the ability to bounce back from these catastrophes as would other developing or developed countries (Loayza et al., 2012; UNISDR, 2013; Nurse et al., 2014). This seems to be related to their unique development characteristics. These include their small economies and populations, and the fragility and interconnectedness of their ecosystems to their livelihoods (Briguglio, 1995, 2003; Adrianto and Matsuda, 2002; Mimura et al., 2007; Guillaumont, 2010). In fact, recent global disaster assessments reveal that future disaster losses threaten the very existence of SIDS (UNISDR, 2015a). This is not particularly surprising given the intricate relationship between disasters and development (UNISDR, 2004; Wisner et al., 2004). While the most recent Human Development Report, 2016, indicates that most SIDS are above the medium development threshold (UNDP, 2015), their extensive vulnerability, and their high exposure to natural threats, mean that disasters can quickly erode their development gains. In addition to the
bleak outlook for disaster impacts on SIDS, climate change is expected to exacerbate the SIDS crisis. An Intergovernmental Panel on Climate Change (IPCC) report which gives special attention to SIDS, notes that they will suffer disproportionate losses from extremes in rainfall, temperature and sea level rise (Nurse et al., 2014). As we understand more about disasters and the intrinsic role of development (Pelling and Uitto, 2001; Mora, 2009; Hay and Mimura, 2010), SIDS development peculiarities may very well call for unique approaches to addressing their impending crisis.

This paper focuses on two approaches that could tackle the SIDS crisis, climate change adaptation (CCA) and disaster risk reduction (DRR). Both DRR and CCA seek to reduce vulnerability and build resilience and as such it has been argued that integration is the most rational way forward (Venton and La Trobe, 2008; Mercer, 2010). However, unmistakable differences in terms of origin, terminology, types/sources of knowledge, institutions and scales (Birkmann and von Teichman, 2010; Glantz and Baudoin, 2014) has lent to parallel institutions and strategies for DRR and CCA in practice. It would seem rather that integrated approaches to address the root causes of vulnerability would be most urgent for SIDS (Kelman, 2013). Notwithstanding at the global level separate agendas persist (Kelman, 2015), and it is therefore not surprising that DRR and CCA integration (hereafter DRR-CCA) in practice has been limited and ad hoc (Shaw et al., 2010; Gero et al., 2011; UNISDR and UNDP, 2012; Rivera et al., 2015).

The discussion around failures in integration in practice has focused around governance (Dhar Chakrabarti, 2010; Gero et al., 2010; Howes et al., 2015; Rivera et al., 2015). Governance discussions in the context of DRR-CCA are emerging in places such as, Mumbai-India (Dhar Chakrabarti, 2010), Cambodia, Nicaragua (Rivera et al., 2015), as well as in developed nations like Australia (Howes et al., 2015), though none so far address the risk decision-making process. A risk governance or risk decision-making perspective provides one approach to conceptualising DRR-CCA in daily development decision-making routines (or day-to-day practice) for managing risk in SIDS. This approach builds on the classical risk management processes of identification, risk assessment, judgement and communication (Renn, 2008; van Asselt and Renn, 2011). The peculiar development characteristics of SIDS may call for a specialised risk governance framework to avoid devastating consequences, but this has not yet been investigated. This paper therefore examines, ‘How can a framework for integrating DRR and CCA risk governance be conceptualised for SIDS?’ Moreover, ‘how could such a framework incorporate the peculiar development characteristics with
The paper is organised into five main sections that are associated with four critical reviews. The first, examines requirements for DRR-CCA integration and a review of SIDS features and their implications for DRR-CCA. Following this, the state of art of DRR and CCA is reviewed. Based on the outputs of these reviews, a fourth review is presented that critically evaluates a leading DRR-CCA risk governance framework for application in SIDS. The study concludes with a review of the possible mechanisms to address the gaps that would make the risk governance framework applicable for SIDS. Finally, an Enhanced Adaptive Risk Governance (EARG) framework is drawn up based on the adjustments needed.

4.2. OVERVIEW OF DRR-CCA INTEGRATION

It is recognised at the international level, that policies and plans towards climate change adaptation and resilience to disasters must be integrated, adopted and implemented in order to make cities and human settlements safe, resilient and sustainable. This is reflected in Goal 11 of the sustainable development goals (Sustainable Development Solutions Network (SDSN), 2012). Furthermore, Goal 13 calls for urgent action to combat climate change and its impacts (Sustainable Development Solutions Network (SDSN), 2012). The recent UNISDR Sendai framework however makes it clear that, ‘Addressing climate, while respecting the mandate of the United Nations Framework Convention on Climate Change, represents an opportunity to reduce disaster risk in a meaningful and coherent manner throughout the interrelated intergovernmental processes’ (UNISDR, 2015b, p.11). As these frameworks demonstrate, integrated approaches to DRR, CCA and development is a globally relevant topic for which there is no agreement on how to take it forward. This paper argues that separate processes are least beneficial to SIDS given their limited resources and catastrophic disaster outlook.

Though there are challenges with integration at the international level, some countries are making progress with integrated approaches to DRR and CCA. As in other parts of the world, however, DRR-CCA in SIDS has been limited to plans and strategies with some indications of institutional adjustment. For example, in The Federated States of Micronesia (FSM) DRR and CCA are institutionalised under one entity (UNISDR and UNDP, 2012). In the Caribbean both climate change and DRR are integrated as cross cutting themes of intra-regional frameworks-the Regional Framework for Achieving Development Resilient to Climate Change 2011-2025.
and the Comprehensive Disaster Management (CDM) Strategy and Framework 2014-2024 (CDEMA) (CCCC, 2011). Examples of integration in day-to-day practice or daily routines are still embryonic (Dhar Chakrabarti, 2010; Gero et al., 2011), though this is where tangible and sustainable reductions in risk are realised. An integrated approach to DRR-CCA can offer SIDS holistic (Mercer, 2010; Chatterjee and Mitchell, 2014), and strategic approaches (Lei and Wang, 2014) to using their resources to reduce socio-economic losses associated with extreme weather and climate events (Hay and Mimura, 2010).

Research has already highlighted key actors (Forino et al., 2015) and features for DRR-CCA integration (Schipper, 2009; Mercer, 2010; Djalante et al., 2013; Gaillard and Mercer, 2013; Kelman et al., 2015). These include polycentric decision centres, engagement/participation across multiple scales from community to regional level, multi-sectoral engagement, and flexibility—self-organising and learning. In the subsequent sections, we show how we build on this previous research. In addition, a few frameworks have already sought to address DRR-CCA in the risk management process but they do not examine the SIDS context. Others focus on one methodological aspect of the risk decision-making process. For example, MOVE (Methods for the Improvement of Vulnerability Assessment in Europe addresses vulnerability assessment only (Birkmann et al., 2013). In other cases, they address risk management overall but not governance e.g. CRAM (Common Risk Assessment Methodology) (Papathoma-Köhle et al., 2016). Furthermore, other frameworks only identify key questions in the decision-making process (Lei et al., 2014b) but do not provide a holistic DRR-CCA risk governance framework. This paper therefore seeks to address two gaps: it provides an overarching risk governance approach to framing DRR-CCA and suggests how such a framework could be conceptualised for SIDS.

SIDS have taken recent steps towards development planning that considers risk. These include the development of risk screening tools such as the Caribbean Climate Online Risk and Adaptation Tool (CCORAL), as well as guidelines that mirror classical risk management processes for example, the Risk Management Guideline for Decision Makers (developed and adapted from the Canadian Standards Association 1997 CAN/CSA-Q850-97, and the AS/NZS ISO 31000:2009 (CARICOM, 2003; CCCCC, 2011). The challenge however, is that these tools give limited attention to DRR-CCA. Moreover, they do not provide a governance approach to the risk decision-making process and provide limited consideration of SIDS development

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6 CCCCC-Caribbean Community Climate Change Centre
7 CDEMA-Caribbean Disaster Emergency Management Agency
peculiarities. Consequently, SIDS may be on a defective and out-dated pathway towards addressing the impending crisis. The first step in developing the conceptual framework for SIDS is to understand the SIDS features to which the framework should respond.

4.3. SIDS DIVERSITY AND COMMON DEVELOPMENT FEATURES

SIDS are geographically located across three regions of the world, a) the Caribbean, b) the Atlantic, Indian Ocean, Mediterranean and South China Sea (AIMS) and c) the Pacific (Pelling and Uitto, 2001). They are therefore situated over large ocean spaces. These countries range from single island states like Barbados and Nauru, to multi island states like the Solomon Islands, and Maldives. There is also great diversity in language amongst SIDS. See Figure 4-1 for the geographic location of the SIDS. SIDS also differ from the perspective that some are uplifting (Vanuatu) while others are low lying (Bahamas). From a geomorphic perspective some may be emergent limestone islands as opposed to atolls or near atoll islands, or continental fringe islands (Forbes et al., 2013). This can have implications for the kinds of threats faced. For example, for many atolls, water security is already threatened by salt-water intrusion associated with sea level rise (Nurse et al., 2014). SIDS also range in development success, ranging from least developed to high developed nations. Most SIDS however are above the medium development threshold, according to the UNDP Human Development Index (UNDP, 2016). SIDS also express great diversity in culture, history, health status, income, life expectancy, and languages (Connell, 2013). There is also diversity in their economies. Some are dependent on commercial fishing and tourism industries (e.g. Barbados) and others are completely dependent on subsistence agriculture (e.g. Vanuatu) and artisanal fishing (Easter, 1999; Liou and Ding, 2002; Turvey, 2007). Also they have varying governance structures, some are governed by hereditary chiefs, mixed NGO and government leadership, and government leadership only (Kelman, 2016). Regardless of their diversity all SIDS have a comparatively small population and size as well as extensive vulnerability (Mimura et al., 2007). The extensive vulnerability of SIDS is characterised by several shared unique environmental, social, economic and physical development factors. It is therefore not surprising that SIDS are specified for special support in the recently adopted sustainable development goals. Particularly those goals related to reducing inequalities amongst countries (goal 10), health and well-being risks (goal 3), education (goal 4), sustainable energy (goal 7) and climate change (goal 13). We use the development commonalities amongst SIDS as a basis for identifying general principles that are applicable particularly for a SIDS framework for DRR-CCA risk governance.
FIGURE 4-1: MAP SHOWING THE SMALL ISLAND DEVELOPING STATES: A) THE CARIBBEAN, B) THE ATLANTIC, INDIAN OCEAN, MEDITERRANEAN AND SOUTH CHINA SEA (AIMS) AND C) THE PACIFIC. SOURCE: PELLING AND UITTO (2001), P.52
The DRR-CCA framework can guide how underlying drivers of SIDS vulnerability that are related to development are addressed. Vulnerability may be defined as,

‘The characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard. There are many aspects of vulnerability, arising from various physical, social, economic, and environmental factors’ (UNISDR, 2009, p.30)

We now examine some of the common features of vulnerability amongst SIDS.

4.3.1. SIDS ENVIRONMENTAL VULNERABILITY

From an environmental perspective, SIDS have high biodiversity and endemism (UN, 1994). The Barbados Programme of Action for the Sustainable Development of Small Island Developing States, which was the first world agreement on SIDS indicates that, island ecosystems are, among the most threatened in the world”, due to their small size, isolation and fragility (UN, 1994, Annex II, preamble, paragraph 6). Other environmental characteristics of SIDS include small exposed interiors, large coastal zone fragile environments and a high interdependence, amongst most SIDS, on the services provided by their environment systems for survival and their livelihoods (Pelling and Uitto, 2001; Nurse and Moore, 2007). This high interdependence puts a strain on the environment and has immense ripple on effects on livelihoods and other social and economic and environmental vulnerabilities (Mimura et al., 2007)

The display of this interconnectedness and its insidious effect in the small economies of SIDS may be demonstrated by recent flooding in Barbados (Downes, 2016) which was not associated with a hurricane or earthquake but an intense rainfall event. Flooding resulted in closure of the entire country with ripple effects on a main estuary. The estuary was overwhelmed by unprecedented rainfall, and contaminated at its outfall, by an overwhelmed coastal sewerage system. The result was a fish kill (or sudden destruction of large quantities of fish as by pollution), and controversial closure of a popular beach. This caused immediate knock on cancellations by visitors and panic amongst tourism businesses with outlooks for a grim winter season (Downes, 2016). It would therefore seem imperative that an integrated DRR-CCA risk governance framework for SIDS address the socio-economic and environmental independencies in their systems and intra-dependencies. The notion of
addressing systems in DRR is still a novel idea however, for CCA, addressing human-environment systems plays a pivotal role (Folke et al., 2005) and begs a deeper evaluation for an integrated risk governance approach.

4.3.2. SOCIAL, ECONOMIC AND PHYSICAL VULNERABILITY

Besides the high interdependences within and amongst socio-environmental systems mentioned, other factors characterise SIDS social vulnerability. These include scarce local skills and human resource; rapid population changes; high per capita costs for infrastructure and services and; concentration of the population in coastal zones (Briguglio, 2010). High per capita costs for services are associated with the fact that SIDS are small. SIDS must still have all of the governance arrangements that would be expected for a functioning country (Briguglio, 2010). These features suggest that any DRR-CCA approach should facilitate innovative decision making in view of the complexities of development and social, environmental and economic constraints in SIDS.

From an economic perspective, SIDS are characterised by few opportunities for economies of scale; high dependency on external influences and linkages for financial support and trade among others (Briguglio, 1995). In addition, excessive dependence on aid and imports; small domestic markets and capital; dependence on natural resources (Adrianto and Matsuda, 2002); and limited diversification of their economies further limits progress in development. Their remoteness and insularity also predisposes them to other factors that affect their economic vulnerability. These include high communication, transport and energy costs, and irregular international transport volumes. In particular, narrow export specialisation exposes their economies to real shocks of intensity unparalleled in larger countries (Briguglio, 1995; Adrianto and Matsuda, 2002). Their economic vulnerability suggests that DRR-CCA governance arrangements should engage economic players. They have a particular role in minimising the imposing economic factors that can make it difficult to have resources for risk management and can also exacerbate vulnerability to disasters (UNISDR, 2013).

With respect to physical vulnerability, SIDS have a comparatively small population size, small geographic size, limited natural resources, remoteness, geographic fragmentation (especially in the Pacific) and are highly exposed to natural hazards (Connell, 2013). Their physical vulnerability may be described as being an inherent factor that they cannot change (Briguglio,
We posit that the physical vulnerability can have implications for the kinds of governance arrangements that are feasible for SIDS as they can affect coordination approaches (Nalau et al., 2016).

Given the complexity and diversity in SIDS a ‘one size fits all approach’ to reducing vulnerability must be avoided (Connell, 2013; Nurse et al., 2014). However, commonalities with respect to the complexity of their socio-environmental, physical-economic characteristics seem to point to the need for a unique DRR-CCA framework that responds to their peculiarities. These specific development characteristics shape SIDS vulnerability as well as the historical, spatial and institutional contexts (Assmuth et al., 2010; Boholm et al., 2012) that influence risk governance processes and supporting structures (Renn, 2008).

Before examining how a risk governance framework could account for SIDS features, in the next section we examine the approach to integrating DRR-CCA that will be taken.

4.4. FITTING DRR AND CCA TOGETHER IN SIDS

The peculiar development characteristics of SIDS present the context within which approaches to DRR-CCA risk governance need to be mobilised. However, there is no agreement on how DRR should be linked with CCA in general. We suggest a framework for DRR-CCA that incorporates CCA in DRR rather than integration into parallel DRR and CCA approaches (Kelman, 2010). We now discuss why CCA should be incorporated in a DRR approach for risk governance, the practical benefits of such an approach, and how CCA could be addressed as part of DRR, for risk governance.

4.4.1. ADDRESSING CCA AS PART OF DRR

DRR is defined as,

‘A concept and practice of reducing disaster risks through systematic efforts to analyse and manage the causal factors of disasters, including through reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events’ (UNISDR, 2009, p.10).
This definition seems to encapsulate all disaster risks, including climate change which may be viewed as another driver of risk that is encompassed in a DRR approach (Kelman, 2013). Furthermore, fundamentally a DRR approach addresses resilience (Cutter et al., 2008; Atta-Ur-Rahman and Shaw, 2015) which also is a common aim of CCA. Despite this, DRR is often discussed within the realms of improved preparedness only (Blackburn, 2014), as opposed to addressing deeper issues related to the underlying drivers of vulnerability. This is problematic since whilst better preparedness has led to massive reductions in lives lost to disasters, losses in terms of capital stock and investments have risen exponentially as has underlying drivers of risk (UNISDR, 2015a). As disasters are now better understood to be the result of complex interactions of hazards (natural or man-made) with social, environmental, political and economic factors that are strongly linked to development, a focus on reducing drivers of risk becomes a necessity (Lewis, 1999; Wisner et al., 2004; Hewitt, 2007). This approach to addressing the root causes of disasters means that DRR actions can mirror several development actions—be it environmental conservation, economic diversification or poverty alleviation.

Climate change is also driving a similar approach though across longer time horizons (Birkmann et al., 2013). Suitable disaster risk reduction approaches could address food security, such as the development of drought resilient crops. On the contrary, there are also several examples where DRR is associated with preparedness (Lamond, 2013) and in these cases, a mutual integration approach has been suggested. Examples include the need for improved prepositioning of supplies, enhanced placement of shelters outside of hazard zones (Papathoma-Köhle et al., 2016), improved inter-connectivity between disaster relief planning and long-term climate change adaptation (Hare et al., 2014), improved evacuation and early warning (Lamond, 2013). Interestingly also, CCA actions are presented that mirror DRR actions by definition, they address underlying drivers which are development problems, and have been carried out for years as DRR actions to address hazard impacts (Porfiriev, 2015). For example—water management, afforestation, land-use planning, building codes, poverty reduction, resettlement and relocation, greening urban environments, climate resilient infrastructure. According to the IPCC, CCA is,

*In human systems, the process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities. In natural systems, the process*
of adjustment to actual climate and its effects; human intervention may facilitate adjustment to expected climate’ (IPCC, 2012a, p.556),

In reality however both DRR and CCA co-exist within the development decision-making sphere and both call for an all hazards, all government, all society approach (Hay and Mimura, 2010; Birkmann et al., 2013; UNISDR, 2015b). It therefore seems that the way in which DRR has been historically understood, has resulted in a narrow understanding of what it is ‘by definition’. ‘By definition’ however, it can encompass risks associated with climate change.

Global climate change which is the result of anthropogenic actions and natural climate variability can affect wild life; ecosystems; health; and livelihoods, and depending on the vulnerability and exposure of these systems it can result in disaster risk (IPCC, 2012b). Impacts may be creeping or sudden. That these ‘impacts’ could be classified as disaster risks is a stretch for some (Pelling and Blackburn, 2013). On the contrary, if DRR were accepted as being mobilised through every aspect of development to avert losses, stronger connections with climate change could be made. In line with others (Klein et al., 2007; Uitto and Shaw, 2016) the approach to DRR-CCA applied in this paper therefore embraces CCA actions under the DRR and rejects a parallel process of mutual integrating as a more rational approach. After all, though climate change drives both hazards and vulnerabilities (Kelman, 2013), as well as impacts on hazard exposure (O’Brien and Downing, 2013), it is only one driver of disasters amongst other stresses (Papathoma-Koehle et al., 2016).

A DRR approach that incorporates CCA, with a further integrating in development processes will be essential for SIDS (Djalante et al., 2013; Begum et al., 2014). This means that development related drivers of vulnerabilities are addressed (Kelman, 2013) by considering how risk will be governed in development related decision making processes. We refer to this approach as the development approach to risk governance; and it can help strengthen social-ecological resilience which is critical for sustainable development in SIDS (Holdschlag and Ratter, 2016). Figure 4-2 summarises the ideas presented thus far on how to DRR and CCA could be conceptualised.
4.4.2. PRACTICAL BENEFITS

The integration of CCA actions within a DRR framework offers opportunities for forward-looking decision-making in the context of highly vulnerable SIDS. It also would contribute to the more efficient use of both human and financial resources. Particularly in the case of SIDS where there is a disproportionately expensive public administration and infrastructure relative to the population and geographic size this would be beneficial. Moreover, the complex connections between their ecosystems and livelihoods would seem to favour an approach that consolidates information and decision-making processes to understand and address vulnerabilities. An integrated approach could allow SIDS to benefit from more efficient CCA policies that build on existing DRR efforts and tools, in the longer-term (Lei and Wang, 2014). It can therefore address uncertainty and ambiguity surrounding adaptation priorities, development plans and budgets (Wisner et al., 2014).

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FIGURE 4.2: MODIFIED FIGURE OF HOW DRR AND CCA CAN REDUCE EXPOSURE AND VULNERABILITY TO WEATHER AND CLIMATE EVENTS, SOURCE, (IPCC, 2012B, P.4) SHOWS AUTHORS’ CONCEPT OF CCA INTEGRATED IN DRR

CLIMATE

- Natural variability
- Anthropogenic climate change

DEVELOPMENT

- Disaster risk reduction
- Climate change adaptation

Disaster

Vulnerability

Disaster risk

Exposure

Weather and Climate Events

Greenhouse Gas Emissions

FIGURE 4.2: MODIFIED FIGURE OF HOW DRR AND CCA CAN REDUCE EXPOSURE AND VULNERABILITY TO WEATHER AND CLIMATE EVENTS, SOURCE, (IPCC, 2012B, P.4) SHOWS AUTHORS’ CONCEPT OF CCA INTEGRATED IN DRR
4.4.3. AN ADAPTIVE/ ADJUSTED DRR APPROACH

Although there are several practical benefits to be accrued to SIDS from a DRR approach that incorporates CCA, adjustments are needed. DRR provides tried and tested knowledge, tools, and approaches to address direct and underlying causes of vulnerability—a shared goal of CCA (UNISDR, 2013; UNFCCC, 2013), however adjustments are needed because climate change challenges the current knowledge on DRR (Pelling and Blackburn, 2013). In line with concerns raised by strong proponents for mutual integrating, it cannot be DRR as usual. Based on the literature an adjusted DRR approach should address three main features of adaptive approaches:

1) Incremental stresses to everyday livelihoods as well as shifting baseline conditions for CCA dressed through learning and dynamic approaches (O’Brien and Downing, 2013).

2) Forward looking CCA assessments that are across planning times (Birkmann et al., 2013).

3) Risk actors have the ability to reorganise entitlements and resources (Pelling and Blackburn, 2013).

By ‘definition’, a DRR approach does not preclude these adjustments and thus conceptually there is no conflict. Adjustments are required however, in ‘day-to-day’ practice that are critical to a SIDS framework. We now discuss how each of these features is applicable to an integrated DRR-CCA approach. Table 4-1 provides a list of key terms that will be applied.
<table>
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<th>Term</th>
<th>Definition</th>
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<tr>
<td>Adaptive Capacity</td>
<td>The ability or capacity of a system to modify or change its characteristics or behaviour to cope better with existing or anticipated external stresses. (Adger et al., 2004, p.34)</td>
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<tr>
<td>Governance</td>
<td>The group of state and non-state actors and processes which are organised horizontally and lead to collective binding decisions without superior authority (van Asselt and Renn, 2011, Wolf, 2002).</td>
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<td>Multi-layered</td>
<td>General-purpose jurisdictions (e.g. providing all services, water, education and planning) that have fixed (durable architecture) and non-intersecting boundaries that operate at a limited number of levels e.g. supranational, national, regional (Hooghe and Marks, 2003)</td>
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<td></td>
<td>Or</td>
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<td></td>
<td>Multi-level governance jurisdictions are not aligned on just a few levels but operate at numerous territorial scales. Jurisdictions are task-specific (a variety of different public service industries, e.g. entity for education alone that crosses community or national level scales) rather than general-purpose, and are intended to be flexible rather than durable (Hooghe and Marks, 2003).</td>
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<tr>
<td>Polycentricity</td>
<td>Multiple governing authorities at differing scales rather than a monocentric unit (Ostrom, 2010b, p. 552) involved in decision making that are formally independent of each other (Ostrom et al., 1961, p.831). It can also incorporate multi-layeredness whereby it means that:</td>
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<tr>
<td></td>
<td>Political authority for managing the risk problems is distributed to separately constituted public bodies with overlapping jurisdictions that do not match the traditional hierarchical order. Klinke and Renn (2012 p. 273)</td>
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<tr>
<td>Social Capital</td>
<td>The networks and relationships between individuals and social groups that facilitate economic well-being and security (Adger et al., 2004 p.35)</td>
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<td></td>
<td>Strong institutional mechanisms and transparency in decision-making, formal and informal networks that promote collective risk handling, education and decision-making power that is assigned. (Klinke and Renn, 2012, p.278)</td>
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<tr>
<td>Systemic</td>
<td>Interactions within and between ecological, social and or economic subsystems human and natural components (coupled human–environmental systems) (Turner et al., 2003)</td>
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<td>Vulnerability</td>
<td>The characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard. (UNISDR, 2009a, p.30)</td>
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<td>Or</td>
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<td>The characteristics of a person or group and their situation that influence their capacity to anticipate, cope with, resist and recover from the impact of a natural hazard (an extreme natural event or process). (Wisner et al., 2004, p. 11). It can incorporate (1) exposure to a hazard or stressor; (2) susceptibility; (3) societal response capacities or lack of resilience and (4) adaptive capacities (Birkmann et al., 2013; Wisner et al., 2004, p. 11).</td>
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4.4.3.1. FEATURE 1 AND FEATURE 2 - LEARNING, DYNAMIC AND FORWARD LOOKING

The first feature, a ‘learning’ or ‘dynamic’ approach to CCA is not presently a part of the DRR approach. Indeed, learning from past shocks alone is no longer feasible for DRR approaches. Instead a systems approach of learning and feedback is needed (O’Brien and Downing, 2013). Notwithstanding the learning and feedback, approach does not account for the complexities and interactions between human and natural systems, which is also a key requirement for SIDS. With respect to the second feature, it is argued that CCA makes the need for forward looking approaches more essential (O’Brien and Downing, 2013). However, neither DRR nor CCA truly takes a long-term approach (Wisner et al., 2014). Both DRR and CCA are undergoing a paradigm shift from looking at static vulnerability to looking at dynamic vulnerability - vulnerability under shifting baseline conditions (O’Brien and Downing, 2013). Another aspect of forward looking is long-term planning. For the risk governance framework, risk management should incorporate actions at different development planning times (shorter to long term) to deal with DRR and climate uncertainty. This approach allows for early adaptation and allows the system to mitigate the disaster risk through reduced social vulnerability (Birkmann et al., 2015) as well as may extend to reducing other vulnerability factors (physical, economic and environmental) (Birkmann et al., 2013).

4.4.3.2. FEATURE 3 - REORGANISE

The final key feature, ‘reorganising entitlements and resources’ may be mobilised through a DRR governance approach that is joined-up and flexible (discussed in (Carey and Harris, 2016)). Moreover it calls for consideration of the ability of systems to adjust or change their behaviour or characteristics to mobilise these resources in order to cope with climate change and climate variability stresses, this is called adaptive capacity (Adger et al., 2004). In the case of SIDS, their development characteristics seem to lessen this capacity significantly given their reduced access to resources. However others (Lee and Smith, 2010) also argue that the smallness of SIDS offers an advantage given the power of agency at the local and national level that can be assembled because of small size. As such, small size should promote social cohesion (Blancard and Hoarau, 2013) and high social capital. Social capital may be understood as the,

networks and relationships between individuals and social groups that facilitate economic well-being and security (Adger et al., 2004 p.35).
Social capital has been shown to be important for coping with climate extremes and variability (Adger et al., 2004). SIDS have been shown to have a high degree of social capital given resources from dense networks, collective action and norms of reciprocity (Petzold and Ratter, 2015). To this end, adaptive capacity and social capital by extension are key elements of a SIDS adaptive DRR-CCA approach to risk governance.

In the next section, we review the Adaptive Risk Governance (ARG) framework, how it responds to the SIDS development context, the features identified for DRR-CCA and for a CCA in DRR approach.

### 4.5. EXAMINING THE ADAPTIVE INTEGRATED RISK GOVERNANCE (ARG) FRAMEWORK FOR DRR-CCA IN SIDS

Much of the concept of risk governance has been applied within the European context and SIDS applications are not forthcoming. Furthermore, though developed and adapted mostly in the area of new emerging man-made risks such as nuclear risks, risk governance frameworks have been applied to mountain risks (Greiving et al., 2014), as well as coastal risk management (Penning-Rowsell et al., 2014) urban planning, and ecology (Sellke and Renn, 2010; Renn and Klinke, 2013; Renn, 2014). As such, its application for DRR and CCA risks seems fitting. We argue that with some adjustments, the Adaptive Integrated Risk Governance (ARG) framework in particular, can be applied to the context of SIDS. We first review the framework, and the advantages for using it as a DRR-CCA conceptual framework for risk governance in SIDS. Gaps are then identified based on the features identified for integration and SIDS.

#### 4.5.1. TRACING GOVERNANCE THROUGH THE RISK DECISION-MAKING PROCESSES

The ARG is a conceptual and model framework for understanding, managing and organising the various ways in which the many actors, individuals, and institutions, public and private collect, analyse, communicate, and decide to regulate risks. These risks are surrounded by uncertainty and complexity in that it cannot be calculated as a function of probability effect. Uncertainty may also be associated with ambiguity that is related to the multiple values and perspectives for evaluating decision outcomes (van Asselt and Renn, 2011). In this regard, the
key features of the framework are the rules, conventions, processes, mechanisms, institutional arrangements, cultures and social dynamics which are used in the framing of risk issues (van Asselt and Renn, 2011). The ARG framework addresses the interface between risk assessment, risk management, regulatory sciences and policy analysis (Renn and Walker, 2008; van Asselt and Renn, 2011). ARG maintains the conventionally accepted elements for risk analysis (assessment, management, communication) (Renn, 2008). It therefore provides a framework where, the principles of governance can be easily traced in the risk decision-making process. The ARG reflects the key features of the International Risk Governance Council (IRGC) (Renn, 2008; Aven and Renn, 2010b; Klinke and Renn, 2012) paradigmatic model for conceptualising governance in risk decision-making (Heriard-Dubreuil, 2001; Marchi, 2001).

Other frameworks are available for problematizing governance, however they do not allow for an easy tracing of governance through the risk decision-making process. Alternatives such as adaptive governance and environmental governance provide overarching approaches to addressing climate change (Lamond, 2013). They focus on reviewing the role of resources, competencies (capacity), public institutions, mandates, private sector and civil society resources, and multi-level governance (Lamond, 2013). Notwithstanding, they do not trace governance through the functional steps of the risk decision-making process. The ARG framework however makes distinctions between the risk processes (risk assessment, evaluation, and implementation) and structural elements (institutions, resources, social capital) of the risk governance process and incorporates key adaptive governance features. See Figure 4-3. The ARG framework therefore provides a helpful guide for conceptualising day-day routine risk governance processes and structures for DRR-CCA. It also allows for challenges related to organisations, standards and behaviours as called for by some (Birkmann et al., 2013) to be identified.
4.5.1.1. DEFINED RISK STAGES THROUGH OVERLAPPING

The steps of the risk governance process as shown in Figure 4-3 are pre-estimation, interdisciplinary estimation, characterisation, evaluation, management, and monitoring. Though shown as defined steps, the stages often overlap (van Asselt and Renn, 2011). In addition to the classical steps mentioned, the ARG includes consideration of stakeholder views and values in two risk governance stages, pre-estimation and risk characterisation. The framework also incorporates a new stage during the risk characterisation stage for the deliberate consideration of the social dimensions of risk (social concern assessment). We now briefly review what is entailed for each of these processes based on Renn (2008) and Klinke and Renn, (2012).

1. **Pre-estimation** - This stage consists of four subthemes, 1) framing, 2) early warning, 3) prioritising (screening), and 4) determining procedures and criteria for screening, assessing and managing hazards and risks (overall governance process). Framing includes identifying what may be classified or labelled as a hazard or potential impact (risk) or problem of concern depending on values, worldviews. Early warning refers to identifying new and emerging threats as well as monitoring new and
reoccurring ones. Prioritising includes selecting and assigning hazards for attention and defining the criteria to be used for this screening.

2. **Interdisciplinary estimation**- Two main stages are carried out in this stage-classical risk assessment along with a key concern assessment step. The risk assessment carried out is interdisciplinary (including natural and social science). Risk assessment includes three processes, 1) hazard analysis (assessment and estimation) 2) exposure and 3) risk estimation. In the hazard analysis stage the behaviour and strength of climate hazards/threats is assessed and its potential harm to society and the environment. Exposure assessment includes identifying people, and elements- physical and environmental assets that may be in contact or exposed to the hazard. With respect to risk estimation, it entails vulnerability assessment and concern assessment. Concern assessment consists of the subthemes: 1) risk perceptions about the climate hazard(s) and potential impacts, 2) social concerns and 3) concerns about potential socio-economic and environmental impacts are incorporated and analysed in terms of how they may attenuate or amplify the overall risk. Perceptions may be included about familiarity and experience with the hazard and potential impacts; degree of control over these potential impacts or risks; degree of trust in risk management organisations.

3. **Risk Characterisation**- In this stage the evidence base is compiled from scientific inquiry in the former stages. This theme includes three subthemes 1) making a risk profile- collecting and summarising evidence on the probability, concerns and consequences of the risk, 2) **judging the seriousness of the risk**- based on the profile and (social norms and values) 3) considering the potential options for handling the risk—defining risk levels (same as evaluation). The risk characterisation stage and the subsequent risk evaluation stage are closely linked and may be merged depending on the circumstances.

4. **Evaluation**-This stage refers to making judgments about whether risks should be accepted (do nothing) or tolerated (addressed) or totally avoided (intolerable) and on the need for risk reduction measures. Risks are usually accepted when remaining risks are so low that further efforts for risk reduction measures are not seen as required. Tolerability refers to an activity that is seen, as worth pursuing (for the benefit) yet it requires additional efforts for risk reduction within reasonable limits (Renn, 2008, p. 189). Here trade-offs and comparisons among risks are considered,
including political priorities (more in Renn, 2008). It is also informed by values and worldviews.

5. **Management** - This stage includes the generating of options for handling the risk. Options could include prevention or mitigation measures as well as risk transfer options such as insurance. The impacts of these options whether economic, technical, social, political or environmental are investigated and trade-offs of the benefits vs. the costs (includes the use of pre-defined evaluation criteria, that are assigned weights based on value judgments) to evaluate the options in close collaboration between experts and decision makers. This process of involvement incorporates various stakeholders and the public directly. See Rowe, Marsh and Frewer, (2004) for guidelines on involvement. GIS multi-criteria tools that promote participation can also be useful tools for involvement. Finally, the preferred option/s is implemented.

3. **Monitoring** - Under this theme observations of the effects of the implementation are evaluated both intended and unintended. It includes feedback from risk management practice.

### 4.5.1.2. COMMUNICATION, DELIBERATION, AND INVOLVEMENT

Each of the foregoing risk process steps is supported by communication, deliberation and involvement as detailed by Renn (2008) and Klinke and Renn, (2012). Communication facilitates the exchange of information among risk professionals and remains essential in the context of SIDS. It is a core feature of the ARG and is infused at the core of the framework Figure 4-3. Information concerning what is happening, how it is happening, roles and responsibilities is exchanged within the circle of those involved in the process (Renn, 2008). It also includes informing and engaging with those who are not involved in the risk assessment and management process with feeding back loops, for example the public and the media (van Asselt and Renn, 2011). In this regard, activities may include building awareness through education, training to assist with coping, creating confidence in institutions, involving risk related decision-making and conflict resolution (Renn, 2008). Straightforward risks involve instrumental institutions to share information as well as natural and social scientists (Renn, 2008). However, when characterising and evaluating risks that are complex, natural and social scientists, policy makers, public interest groups and directly affected stakeholders should also be involved in the process (Renn, 2008).
The process of identifying overarching common values, and in defining options that don't compromise the vision of others, is at the crux of resolving conflicting expectations in the deliberation process (Renn, 2008). While tools, knowledge and capacity are needed for risk decision-making, the key reasons for why disaster losses increase often stems from how risk is interpreted and understood (Eiser et al., 2012). The deliberation process is a way for the ‘mind-sets’ (personal attitudes, values, world views) of actors operating across different scales (regional, national, community) and operating in different power structures to be addressed. Arguably, this approach could be frustrating for SIDS in terms of complexity and resource requirements since even in resource rich circumstances resourcing participatory processes is difficult (Renn, 2015). A number of methods however, could be employed in the case of SIDS with appropriate innovation. Innovation is an essential aspect to adaptive approaches (Baird et al., 2016). Deliberative methods could include round tables or open forums, mediations, advisory committees that openly discuss competing arguments, beliefs, and values may be applied for the appropriate involvement of the various stakeholders in the risk governance process (Renn, 2015). Junctures for involvement should be identified as not all stakeholders participate in all stages of the risk governance process (Renn, 2015).

4.5.1.3. RESOURCES AND ASSETS FOR RISK GOVERNANCE

In support of the risk governance processes, the framework includes necessary human resources, capacity (technical and financial) as well as other supporting institutional elements, similar to other DRR-CCA frameworks (Ahrens and Rudolph, 2006; Djalante, 2013). Social capital, which has been discussed as an important feature for SIDS (at section 4.4.3.2) is also included. Each element is equally important to the SIDS context.

i. Human resources refer to expertise, ‘capacity’ and knowledge (Klinke and Renn, 2012). It can also include addressing knowledge gaps (integrating indigenous or local knowledge for CCA-DRR which from a SIDS perspective is necessary (Mercer, Kelman, et al., 2012; Hiwasaki et al., 2014) for integrated systems approaches. It could also incorporate education as called for by others (Begum et al., 2014).

ii. Knowledge is understood to be from various sources and disciplines. It not only refers to the integration of academic knowledge, but also experiential and indigenous knowledge but includes uncertainty in information and articulations of risk perceptions and values (van Asselt and Renn, 2011). This is particularly an important element for SIDS risk governance frameworks (Ikeda and Nagasaka, 2011).

iii. Technical resources refer to the availability of tools, software, and hardware.
iv. Institutions refer to the laws, norms and policies, formal and informal networks, and institutional mechanisms which could also address political will— which is critical for DRR-CCA (Begum et al., 2014).

v. From a risk governance perspective, social capital refers to strong institutional mechanisms and transparency in decision-making, formal and informal networks that promote collective risk handling, education and decision-making power that is assigned (Klinke and Renn, 2012). As discussed previously (at section 4.4.3.2) it could be quite strong in SIDS.

4.5.2. KEY FEATURES FOR INTEGRATION- POLYCENTRIC, MULTI-SECTORAL,
MULTI-LAYERED

The ARG framework also incorporates key features for DRR-CCA that are also applicable in SIDS. In alignment with other adaptive governance frameworks (Djalante, 2013), elements such as, polycentric decision-making, multiple sectors and stakeholders across different scales (community to regional level), are threaded through the framework. Multiple sectors and stakeholders are included in the framework through an 'involvement' feature mentioned at section 4.5.1.2. This extends the idea of inclusiveness and addresses co-creation of knowledge, as well as collaboration both vertically (across scales and levels) and horizontally (within levels and geographic regions) (Olsson et al., 2004). It includes cooperation across disciplines, coordination across networks, and multi-layered institutions (regional, national, community levels) (Renn et al., 2011). As mentioned in section 4.5.1.1 the ARG also applies an interdisciplinary estimation of risk that brings together social science and experts and including indigenous knowledge to help address issues of complexity that may be found in SIDS. Multi-sectoral engagement and inclusion allows the various stakeholders to contribute systematically to how risk is managed (Renn, 2015).

4.5.3. ARG FEATURES THAT RESPOND TO AN ADJUSTED DRR APPROACH
FOR CCA

In view of the characteristics of the ARG we now examine how the ARG addresses the development features of SIDS (in section 4.3) and the main features required for an adjusted DRR approach that incorporates CCA (in section, 4.4.3). We looked for evidence that the ARG was development focused; that it applied systems approaches, provided a dynamic/ learning, forward looking, and a flexible framework.
We found evidence that the ARG provides an improved conceptualization of flexibility and learning in the governance process. In particular, the ARG framework adds new dimensions to risk governance that reflect the need for more flexibility (Renn, 2005; Aven and Renn, 2010a; Wachinger et al., 2013) particularly to the uncertainty introduced by climate change (Renn et al., 2011). This also responds to the complexity of the dynamic nature of risk governance processes (Boholm et al., 2012). For example, a new stage for early detection of new risks called pre-estimation is incorporated. This is pertinent to the SIDS case since climate change threats of sea level rise, increases in air temperature and sea water temperatures are more gradual and may be perceived to be of less danger comparative to more sudden and common events such as hurricanes and earthquakes (Aswani et al., 2015). CCA planning strategies in the SIDS must be more anticipatory. In this regard, local scientific studies and local observations of on-going ecological changes are necessary (Aswani et al., 2015). The ARG also addresses learning from policies and experience, with notions of feedback, flexibility through the ‘deliberation’ process which is at the core of the framework (May and Plummer, 2011; Klinke and Renn, 2012; O’Brien and Downing, 2013).

The ARG however has three main gaps that relate particularly to the SIDS development characteristics.

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4.5.4. GAPS IN THE ARG FRAMEWORK
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The three gaps in the ARG are related to a 1) limited systems approach, 2) limited development approach and 3) inadequate treatment of adaptive capacity in the risk governance framework. These gaps are discussed respectively.

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4.5.4.1. LIMITED SYSTEMS APPROACH
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In some applications of the ARG (e.g. planning) there is acknowledgement of interconnections and interactions in risks and the need to manage systems (Renn and Klinke, 2013). However, a central systemic approach in the framework for addressing the intricate connections between and within SIDS socio-economic and environmental systems is not addressed. The complexities and ambiguities of the socio-ecological system must be recognised for resilience building (Chatterjee and Mitchell, 2014). Similarly, Hay and Mimura (2010) and Briceno (2015), highlight the importance of the socio-ecological aspects for integrating risk reduction in development planning. Moreover a better understanding of the linkages between
ecosystems and human societies can assist in vulnerability reduction particularly in coastal areas (Adger et al., 2005). The 5th IPCC assessment report states that the resilience of many ecosystems is likely to be exceeded by a combination of change in climate, global drivers, like pollution and disturbances like flooding and that coral reefs and mangroves are among the most vulnerable ecosystems (IPCC, 2014). Adaptive approaches that help to respond to the uncertainty posed by climate change and how systems may respond in the future must be systematically addressed in a SIDS context. A systems approach is needed that goes beyond feedback loops but should identify and address systems interdependencies, and interactions.

4.5.4.2. LIMITED DEVELOPMENT APPROACH

As mentioned in section 4.4, addressing DRR and CCA as part of development processes is essential. The ARG takes account of how different dimensions of development may affect risk through the vulnerability assessment and social concern assessment. It also involves a number of stakeholders (that could include development stakeholders) through participatory processes for the estimation and characterisation of risk. Nevertheless, SIDS require a development approach that strategically aligns the processes and roles for risk governance with development processes. ARG assumes that public policy ensures that all necessary safety and control measures are implemented and enforced particularly for routine risks (Renn, 2015), however in the case of SIDS structures for managing risks are not necessarily in place. While the ARG emphasises that explicit roles for risk governance are provided and identifies a number of institutions as important for handling risk- academics, private and public institutions (e.g. building standards organisations) and political regulatory agencies such planning departments (Renn and Klinke, 2013), this does not fully capture the development approach to risk governance that is needed in SIDS. This must however go beyond a mere acquiescence of development as the context in which risk governance is taking place. The development sectors should provide the means for the strategic positioning and implementation of risk governance processes and therefore drive systematic analysis and management of the causal factors of disasters- whether economic, social, or environmental (Djalante et al., 2013; Begum et al., 2014).

4.5.4.3. LIMITED APPROACH TO ADDRESSING ADAPTIVE CAPACITY

The dynamic, flexible, feedback and learning features of the ARG can help capture complexities of the SIDS systems-, which are helpful for identifying adaptive capacity. The challenge however is that adaptive capacity is not assessed explicitly in the ARG. Adaptive capacity is not equally distributed within societies (Adger et al., 2009). It is also dependent on
an individual's access to resources (Adger et al., 2004) however the ARG does not assess this. Furthermore, issues with the level of economic activity and more so with social infrastructure and the accountability of institutions can affect adaptive capacity - SIDS are faced with both of these challenges (Adger et al., 2004). Understanding the adaptive capacity in the risk governance process would allow for the identification of potential capacity to reduce or increase the system's vulnerability to hazards. This applies to, hazards occurring in the future (allowing the system time to adapt in an anticipatory manner) or to hazards that involve slow change over relatively long periods, to which the system can adapt reactively' (Adger et al., 2004, p.36). Furthermore some SIDS may have a higher ability to act collectively when faced by threats from climate variability and change (which is an element of adaptive capacity (Adger et al., 2004) than other places (Cinner et al., 2012). This potential or the lack thereof is not assessed in the ARG.

4.6. THE ENHANCED ADAPTIVE DRR-CCA RISK GOVERNANCE (EARG) FRAMEWORK FOR SIDS

In this section, we discuss possible mechanisms through which gaps found in the ARG could be addressed to facilitate its application to the SIDS context. This is followed by a summary of an Enhanced Adaptive DRR-CCA Risk Governance (EARG) framework. We propose three new responses to each of these gaps, each of which are discussed below.

1. A systems approach to understand and address vulnerability at the process level of the ARG.
2. A joined-up governance approach at the structural level that supports the systems approach.
3. An explicit development approach that is intertwined in the systems and joined-up approach.
Given the intricate connections amongst ecosystems, and socio-economic systems and the significant impact that failures in these systems can have on SIDS, we suggest a systems approach that is situated at the core of the framework. The systems approach proposed supports a key sustainable development goal whereby by 2020 there is integration of *ecosystems and biodiversity values into national and local planning, development processes, and poverty reduction strategies and accounts* (Sustainable Development Goal, 15.9). Fundamental to the systems approach is recognition of the intrinsic relationships between social, economic, cultural, political and other systems (O’Brien and Downing, 2013). The approach is appropriate for dealing with climate change and complex systems (O’Brien and Downing, 2013). It also addresses uncertainty (Buurman and Babovic, 2016). A systems approach (Djalante, 2013; O’Brien and Downing, 2013) or systemic approach accounts for the wider context of how processes change as well as how different pathways to development influence the social, economic, political and institutional context within which risk is created and experienced (O’Brien and Downing, 2013). It includes assessing the human and natural components and interactions as well as the external drivers and system responses (Polhill et al., 2016). It therefore offers a higher level view as opposed to a lower level of a working solution (Reyer et al., 2012) to risk decision making process.

Systems approaches are characteristic of some integrated approaches (Romieu et al., 2010) and have been incorporated to some degree in frameworks such as MOVE (Birkmann et al., 2013) that address DRR-CCA for vulnerability assessment. From a disaster management perspective it has been applied to investigate potential failures in preparedness and response systems (Pascale et al., 2009; Lozoya et al., 2011; Khazai et al., 2014)- specifically to look at interdependencies and intra-dependencies of vulnerability to physical systems such as transport systems (Pitilakis et al., 2016) and electrical systems (Menoni, 2001; Powell et al., 2016). CCA however contributes advanced models for understanding and modelling system interactions that should be incorporated in the ARG. Applications of systems approaches are found across adaptive literature, such as for farming and food systems (Ingram, 2011; Giuliani et al., 2016), building systems such as drainage systems and transport systems, and water systems (Gain et al., 2012).

Furthermore, we recommend that the systems approach be operationalized in each of the development processes including ecosystems. See Munang et al., (2013) for suggestions on
the way forward with integrating DRR and CCA using ecosystem based approaches. We therefore suggest that each development sector identifies the systems of interest and then related and associated sub systems and interactions with other systems. For example, the environment sector (ecosystems), planning sector (building systems including drainage) and agriculture (food systems) and so on. It is at this point that the risk governance steps are initiated from the systems perspective across time and within varying scales of assessment and action in each step of the risk governance framework (Lei and Wang, 2014). Particularly hazard, risk and vulnerability assessment with the inclusion of climate scenarios as well as management approaches (Papathoma-Köhle et al., 2016) can reflect this flexibility. Systems should be assessed deliberately across long-term and short-term plans to address incremental shifts in climate (Field et al., 2013 in Birkmann et al., 2013). At this juncture, rather, adaptive adjustments are mobilised by considering uncertainties and different scenarios across time and space (whether at the community, national or regional level). See Buurman and Babovic, 2016. The principles and methodologies are transferred to function in an integrated framework where once before these were two separate processes.

It has been argued that systemic approaches better support cross-sectoral strategies as well as multi objective actions (Papa et al., 2015). The application of a joined-up cross-sectoral element to support the systems approach in the framework is discussed in the next section.

4.6.2. DEVELOPMENT, JOINED-UP GOVERNANCE AND ADAPTIVE CAPACITY ESTIMATION

All SIDS are still developing countries, as such sectors that manage social sector processes and institutions involved with poverty alleviation and health are important. Other main sectors that manage the built and natural environment, social and economic systems would also be important for mainstreaming the risk governance approach. These are key pillars of integrated frameworks (Djalante et al., 2013). Economic sectors include tourism, transportation, energy and agriculture including fisheries that would need to incorporate risk governance in their day-to-day processes. We therefore include environmental/ coastal planning and conservation, land-use planning, and water and other sectors such as sustainable tourism development in the enhanced ARG. Since climate change and disasters also affect culture, a risk governance approach in this sector is suggested. Cultural dimensions that may be threatened by climate change include lives and livelihoods that include the material and lived aspects of culture, identity, community cohesion and sense of place (Adger et al., 2013 p. 1). The cultural sector underpins key sectors in SIDS, such as
tourism, and so day-to-day decision-making processes concerning culture can look to see how culture can be protected and risks minimised through a risk governance approach. Protecting culture and meeting cultural requirements in how disasters are addressed are incorporated under priorities of the Sendai Framework for DRR (UNISDR, 2015b) and it is relevant particularly for SIDS. Partners from the ‘culture’ sector are also vital when understanding and interpreting risks since culture impacts how societies respond to and address climate change and disasters (Adger et al., 2013; Mercer, et al., 2012). Other sectors such as poverty alleviation given the developing country context are also important for the mainstreaming of this approach.

Recognising that there is great diversity amongst the SIDS in terms of key sectors driving their economies and how their governments are set up, it seems that it could be expected that there would be variation in terms of the specifics of how, and the tools that support joining-up and coordination. This requires balanced approaches for addressing the varying scales of connection and interaction for governance but does not preclude the basic principle of joining up across development sectors.

We have suggested that a systems approach be applied across each of these sectors. This kind of approach seems to require a new paradigm shift in governance across sectors in SIDS. We suggest that at the first level, each sector takes responsibility for risk decision-making concerning disasters and climate change for a cross-sectoral approach. This means that policies for vulnerable sectors such as agriculture, water resources, health, land use, environment, finance and planning in particular should integrate approaches to DRR and CCA in their policies and policies are coordinate towards a shared vision. Ensuring that DRR-CCA includes vulnerable sectors has been argued as necessary for the advancement of integration of DRR and CCA (Begum et al., 2014). The approach is holistic and integrated across sectors and allows for a feasible approach to the massive issue of addressing underlying drivers of risk particularly in SIDS. Furthermore, within each sector, development institutions through the corresponding sector processes (land use planning inter alia) mentioned for carrying out their mandates; undertake respective aspects of the risk governance process. This kind of approach calls for coordination across sectors (Begum et al., 2014) and institutions. Coordination is necessary to address the overall ripple on effects of impacts from climate change on social systems and to avoid maladaptation (Adger and Barnett, 2009). Convergence between disaster risk reduction and climate change adaptation necessitates robust national and global coordination mechanisms (Hay and Mimura, 2010). Each sector
will need to establish the junctures for engagement. The joined-up and networked approach has been suggested as a powerful way for CCA to maximise the potential benefits of established DRM networks (Howes et al., 2015). This approach could bring distinct benefits to a SIDS context of limited resources. It also complements other suggestions for SIDS to integrate development strategies, ecosystems based and expenditure frameworks for effective sustainable development (Lal, 2011).

A holistic cross-sectoral approach should also include social actors such as NGOs and representatives of vulnerable groups. As well as actors at the state level as well as at the market level (Forino et al., 2015) who have been identified as important for DRR-CCA. In addition, it seems necessary that given the resource constraints in SIDS that intra-regional organisations are important to the process. To this end, the process is across scales starting with community (Djalante et al., 2013) which is at the core- particularly since the impacts of climate change and disasters are felt at the level of community. It then moves outwards to the intraregional level. A development approach to integrated and adaptive risk governance in SIDS requires that each of the actors is engaged in the process however the processes/junctures for their engagement in the case of risk governance in SIDS conceptually are addressed under the supporting element ‘institutions’. A deeper assessment of how this might happen in SIDS is required. In this regard, prior elements in the ARG for integration-self-organisation and networks are emphasised (Djalante et al., 2013). Supportive of this kind of inter-agency collaborative approach in other country contexts point to the need for shared policies (purposes, values, visions), multi-level planning, integrating legislation, networking organisations and establishing cooperative funding (Howes et al., 2015). All of which seem to align with the principles of joined-up government which seek to remove ambiguities and blockages between different polices, to deliver integrated services to address complex issues (Howes et al., 2015). It does this through partnership creation across and within sectors, improved use of resources, improved conduits for sharing ideas, and cooperation between stakeholders (Howes et al., 2015). Figure 4-4 shows an inset of the systemic approach which is at the centre of a joined-up development approach to risk governance.
This kind of joined-up approach is however not without its challenges. In liberal democratic developed countries where joined-up governance has been practiced, not necessarily in the context of risk governance, there still remains substantial barriers to real change (Howes et al., 2015). There are structural obstacles of government hierarchy and historical mistrust across jurisdictions as well as duplication that create hindrances (Howes et al., 2015). Moreover the dynamic nature of joined-up working is proving to be a significant impediment to management (Carey et al., 2015), notwithstanding a number of solutions are emerging to address this new kind of governance. The context of SIDS remains to be tested but it seems like this could be a manageable and promising case with the appropriate legislation, resources and leadership.

Finally, we suggest that adaptive capacity could be examined as a sub-element of the interdisciplinary stage (See Figure 4-5). We recommend that this includes an assessment of institutions for resource management, their effectiveness, efficiency and legitimacy as part of the vulnerability assessment (Adger et al., 2004). Petzold and Ratter (2015) also suggest a
mechanism for assessing adaptive capacity, it emphasises assessment at the community level but also household and individual level.

**FIGURE 4-5: ADAPTIVE CAPACITY ASSESSMENT AS AN ELEMENT OF RISK GOVERNANCE (AUTHOR'S FIGURE, MODIFIED FROM KLINKE AND RENN, 2012 P.279 )**

4.6.3. ENHANCED ADAPTIVE RISK GOVERNANCE CONCEPTUAL FRAMEWORK FOR SIDS

Figure 4-6 shows a summary of an Enhanced Adaptive Risk Governance Framework (EARG) for DRR-CCA in SIDS. It incorporates the new features discussed in the foregoing section. It shows five main themes for DRR-CCA risk governance in SIDS. These themes reflect 7 key principles for SIDS: 1) development sector integration, 2) an adapted DRR approach that incorporates CCA principles of networks and self-organisation, forward looking (across time scales- present, seasonal, future), 3) adaptive capacity as pivotal to risk estimation, 4) multi-layered and polycentric engagement, 5), deliberation and involvement (interdisciplinary and integration), 6) systemic/ systems approach and, 7) joined-up governance. Adjustments are shown particularly with respect to theme 1, theme 2, and in the additions of theme 4 and theme 5.
FIGURE 4-6: ENHANCED ADAPTIVE RISK GOVERNANCE FRAMEWORK FOR SIDS
Theme 1
This layer reflects the development approach in which risk governance is integrated into development sector processes. This idea is expanded at the core of the figure (#4). Moreover, the DRR-CCA approach to risk governance is reflected across time scales and across space scales at the intra-regional, national and community levels. Time and scale/ space are considered across each stage.

Theme 2
This theme maintains the key areas as cyclical processes without a specific beginning or ending. An addition to the framework’s processes however is adaptive capacity, which is now an element of the interdisciplinary estimation stage. Other adjustments recommended include, a vulnerability assessment approach that is informed by the systems approach. This means that vulnerability assessment includes analysing the social, economic, physical or environmental conditions that may cause susceptibility of these elements of the system to the climate hazard. It involves looking at systems interactions and dependencies. In the risk assessment, stage possible socioeconomic or environmental losses and damages from hazards are estimated. Under the concern assessment, this stage now includes estimation of the adaptive capacity. With respect to characterisation, risks are understood to be multiple and interconnected- systemic. No adjustments are made to evaluation and management and monitoring themes.

Theme 3
This theme maintains the deliberative approach, communication and involvement at the core with one adjustment that emphasises the science policy interface to support the necessary exchange of information and collaboration needed for the risk governance process.

Theme 4
Core to the risk governance process in SIDS is the systemic or systems approach (shown at 4). The systemic approach infuses the entire risk governance process and steps. It is through this approach that the development context supports the framework. This is explained at the lower level of the figure, which reflects three development systems through which the steps of risk governance are integrated. These three systems are the built and natural environment, social and economic systems. Associated with each system is, respective sectors and institutional processes for further mainstreaming of the risk governance approach according
to institutional mandates. Each institution has its own visions and contexts which inform day-
to-day practice, which is the core level at which the systems approach to the risk governance
approach should be integrated. They also inform the steps of the risk governance process. It
is expected that not all institutions would perform each functional step of the risk governance
process. Rather, resources, institutions and mandates determine this. Moreover, we further
maintain the supporting elements of, human resources, social capital, financial and technical
resources, as well as institutional means as key requirements of the SIDS conceptual
framework. Institutional means which include laws, norms, policies, formal and informal
networks, institutional mechanisms, can include the ‘political will’. We suggest however, that
rather than distinctive risk governance steps, that where possible that these are associated
with the development processes through which the risk governance process should be
integrated. This kind of approach would maximise institutions and resources and seems more
practical given the limitations of SIDS.

**Theme 5**

To further support this joined-up approach, we introduce at the bottom level of the figure
(shown as # 5) the joined-up government and network approach that seems to be a
necessary addition for SIDS. An overarching institutional approach may be needed to
coordinate and govern the systemic DRR-CCA risk governance approach in SIDS. This
approach is multi-layered and polycentric which are two key principles of DRR-CCA
frameworks.

4.7. CONCLUSION

We set out to examine how a framework for integrating DRR and CCA risk governance can be
conceptualised for SIDS and how it could particularly incorporate the peculiar development
characteristics with which SIDS are associated. We have contributed four new features not
previously found in overarching risk governance frameworks as necessary in the SIDS
context. These are:

1) A DRR-CCA risk governance approach that is integrated in development
institutions and undertaken as part of day-to-day development processes for managing the
systems for which they are responsible

2) A systemic core principle, which addresses their complexities and
interconnectedness of their systems that is supported by
3) A joined-up government and networked approach to DRR-CCA in risk decision-making processes and

4) An adaptive capacity element to how risk is estimated in the risk governance process across time and space.

We have built on the ARG framework that allows for the principles of governance to be easily traced in the risk decision-making process. The framework also incorporates key features previously identified for DRR-CCA integration. It therefore includes polycentric decision centres, engagement across multiple scales from community to regional level, multi-sectoral engagement. Contrary to international positions, however that perpetuate parallel DRR and CCA processes with mutual integration, we suggest a framework that sets these four new features in an adapted DRR approach in which CCA is integrated. This approach seemed to be the most practical approach for SIDS. The new features of the EARG that we have suggested are not new concepts, however many of them are still emerging in practice and have not been previously applied to an overarching risk governance framework.

While approaches such as joined-up governance are still undergoing teething issues and systemic and development approaches to DRR-CCA are emerging, they promise enormous benefits to SIDS and should be urgently examined and tested for adoption. They will require transformational changes in SIDS institutions, and leadership as well as bottom up willingness to challenge the status quo at the national level and international level. Current classical risk management approaches in SIDS that do not address their peculiar development characteristics may very well be setting them on the wrong path towards addressing their catastrophic disaster outlook. The EARG framework sets a foundation for innovative research for SIDS that is needed to inform policies that provide root-based solutions to the existential threat from disasters in the near-term and in the long-term from climate change. Future research should investigate how SIDS measure up to the framework's requirements and can explore how to bring about the change that it necessitates incrementally or otherwise. Further work is also needed to test the framework in different SIDS case contexts to see whether there are variations amongst the SIDS in practice given the diversity in governance. This will also provide further evidence for SIDS to shift from ad hoc solutions to practical implementation.
ACKNOWLEDGEMENTS

The author is a Commonwealth Scholar, funded by the UK government. Thanks are extended to the Government of Barbados Department of Emergency Management for the support provided in facilitating contact with members of the national emergency management team and for hosting this research during the 6 months of data gathering. Additionally thanks are extended to all the participants who generously gave of their time to participate in the research.
CHAPTER 5. PAPER 2: DOES SMALLNESS HELP? SOCIAL NETWORKS AND CONNECTEDNESS IN DISASTER RISK REDUCTION AND CLIMATE CHANGE ADAPTATION IN BARBADOS, A SMALL ISLAND DEVELOPING STATE

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ABSTRACT

Integrated Disaster Risk Reduction and Climate Change Adaptation (DRR-CCA) frameworks offer several advantages particularly in contexts that are highly threatened by extreme weather, with fragile, complex socio-environmental systems and limited resources. Nevertheless there has not been much progress with DRR-CCA. This is the case of Small Island Developing States (SIDS). SIDS are defined by a number of development disadvantages, however their smallness may offer some advantages to DRR-CCA related to assumed higher social capital. Using the case of one SIDS, Barbados, we examined the potential for DRR-CCA from the perspective of risk governance. We applied a SIDS DRR-CCA conceptual framework to examine whether there was potential for integration in principle that is in policy and legislation and in practice networks. This paper draws on findings from document analysis and social network analysis of surveys from organisations working in CCA and DRR. We found that Barbados has modest potential for DRR-CCA. This was related to 1) different kinds of polycentricity displayed in the network, 2) a highly dense network that lent to better information sharing as well as, 3) key brokers that could serve as important points for sharing and flexibility. It also seemed that the disaster management network offered a high potential for DRR-CCA. With the exception of the high density of the network displayed, smallness did not necessarily result in more potential for DRR-CCA risk governance. A number of challenges were also highlighted that could hinder the potential seen. In this
regard, deeper analysis of these challenges towards the development of solutions that could allow SIDS to exploit their potential for DRR-CCA risk governance is a necessity.

**Keywords** - disaster risk reduction, climate change adaptation, risk governance, social network analysis, Small Island Developing States
5.1. INTRODUCTION

We live in an increasingly risky landscape (UNISDR, 2013), which makes it a necessity to ensure that approaches that can minimise our risks such as disaster risk reduction (DRR) and climate change adaptation (CCA) are effective. The close linkages between DRR and CCA have resulted in growing interest in integrating the two (Mercer, 2010; Kelman et al., 2015). Integration is a potential solution to increasing demands for reduced duplication, effective use of resources and holistic governance (Schipper, 2009; Gero et al., 2010; Mercer, 2010). Both DRR and CCA perspectives recognise the role of hazards in creating the stresses that result in disaster, but also more critically, how the complex interactions of hazards with underlying socio-economic and environmental vulnerabilities can create disaster (IPCC, 2014). Reducing vulnerability is therefore at the core of DRR and CCA (Venton and La Trobe, 2008)- vulnerabilities that are driven mostly by our development choices and pathways (IPCC, 2014; UNISDR, 2015a). Whilst this commonality can serve to unite DRR and CCA approaches, climate change introduces uncertainty and ambiguity (Pelling and Blackburn, 2013) that integration approaches must account for. Not only does climate change affect the hazard, but baseline vulnerabilities (O’Brien and Downing, 2013). Research has identified that disaster risk reduction and climate change adaptation integrated approaches (DRR-CCA) must be community centred (Djalante et al., 2013), and engage multi-layered (or multi-scaled) institutions (Hooghe and Marks, 2003). DRR-CCA should also entwine participation, as well as promote collaboration and inclusiveness (Schipper, 2009; Mercer, 2010; Djalante et al., 2013; Gaillard and Mercer, 2013; Kelman et al., 2015). Moreover, dynamic learning and feedback loops that function across network institutions are vital (O’Brien and Downing, 2013). Finally, DRR-CCA necessitates various kinds of governing authorities at different governance scales (McGinnis, 1999) to be engaged in the overall approach for addressing the root drivers of vulnerability. This is a polycentric and multi-layered approach to governing risk. This approach is preferable to single centre governance due to increased potential for adaptability to different social and ecological scales (Folke et al., 2005). It also improves application of knowledge to societal processes and action (Lebel et al., 2010). Furthermore it promotes, knowledge sharing, learning (Ostrom, 2010a), cross fertilization of ideas (Berkes and Folke, 2002) and collaboration (Folke et al., 2005).

Country regions such as Small Island Developing States (SIDS), have peculiar development characteristics that predispose them to intensity shocks unparalleled in larger countries (Briguglio, 1995; Adrianto and Matsuda, 2002). These include high exposure to natural hazards, small geographic size, limited natural and human resources, small and undiversified economies, disproportionate high costs for public sector administration (comparative to their population size), small populations and high interconnectivity of livelihoods to their
ecosystems (Briguglio, 1995). This predisposition to risk has contributed to SIDS being one of the most threatened regions to climate change (Nurse et al., 2014), as well as being at more risk to disasters than regions such as Europe and Central Asia (UNISDR, 2015a). There is therefore an urgent need to assess the potential for DRR-CCA in the SIDS context in view of their risks and the expected benefits that can be gained from integration. Research shows that irrespective of entrenched differences between DRR and CCA (Birkmann and von Teichman, 2010; Glantz and Baudoin, 2014), a DRR-CCA approach is beneficial to SIDS (Kelman and Khan, 2013). Furthermore, the SIDS context requires a tailored overarching approach to address DRR-CCA risk decision-making processes—also called risk governance (Greenidge et al., submitted). Risk governance approaches highlight the role of actors, networks, individuals and institutions, in the risk decision-making processes of pre-estimation, interdisciplinary estimation, risk characterisation, evaluation, management, monitoring, and communication (Renn and Walker, 2008), in the face of uncertainty, complexity and ambiguity (van Asselt and Renn, 2011). However, the SIDS context requires that there is a development focus to risk governance that joins-up all actors, incorporates adaptive capacity assessment and makes systems the core of the framework (Greenidge et al., n.d.).

Not only does the SIDS context shape how DRR-CCA approaches should be governed, but it may offer potential advantages that promote integration. For example, smallness has been associated with heightened social cohesion and social capital (Blancard and Hoarau, 2013). In particular, increased social capital may establish and strengthen networks in small settings relative to other country contexts (Lee and Smith, 2010; Connell, 2013) and could enhance related features supporting DRR-CCA such as polycentricity, and collaboration. Therefore it might be expected that decision-making in SIDS already has an element of integration through existing structures and communication networks. The extent to which this is true has not yet been examined in particular SIDS cases. Besides the potential advantages for these networks and structures that may be associated with heightened social capital for example, SIDS may exhibit other key characteristics that could provide incentives for advancing DRR-CCA in day-to-day practice.

The Enhanced Adaptive Risk Governance (EARG) (Paper 1) has been developed to incorporate features for DRR-CCA in the context of SIDS (Greenidge et al., n.d.). We use this model as a means of comparing existing structures and processes in order to determine the extent to which they already exhibit integrated features, or have the potential to do so. A mixed methods approach is applied to understand the DRR and CCA risk governance processes, communication networks and institutional structures in SIDS and how they could
support an integrated approach. To this end, this paper seeks to answer the following question: **How do existing DRR and CCA institutional structures and processes in Barbados exhibit the potential for integrated risk governance?** This is addressed through two connected questions. The first considers integration ‘in principle’ and asks how far do existing governance structures for DRR and CCA already connect with one another and exhibit features identified as important for integrated DRR-CCA? The second considers integration ‘in practice’ specifically the nature of process networks around DRR and CCA. It focuses particularly on communication, and considers which actors are involved, and asks, to what extent these actors are they connected, and how do they contribute in the risk governance process? In this research, we use the example of Barbados, a Caribbean SIDS and investigate whether Barbados’ DRR and CCA risk governance processes exhibit the potential for integrated risk governance. Document analysis is used to establish the current policy and practice landscape around DRR and CCA, and social network analysis is used to understand the networks around decision-making in these areas.

The paper is arranged into four main sections. The first is an overview of the EARG conceptual framework highlighting particular requirements for DRR-CCA integration and how they might be recognised in governance documentation and practice networks. This is followed by a presentation of the findings on the features of DRR -CCA risk governance exhibited in the documented structures and processes, that is, in principle. The third section presents the findings on practice, from the interactions and interconnections revealed by social networks. It focuses on communication and the DRR-CCA features exhibited ‘in practice’. Finally, we seek to identify lessons that may be applicable to other SIDS.

### 5.2. CASE DESCRIPTION

We use the case of Barbados, a SIDS for investigation. It is located at 13°10 N, 59°32 W, and is the most easterly Caribbean nation state. Though located in the North Atlantic Ocean, it is just 100 km east of the Caribbean Sea and is part of the Lesser Antilles of the Caribbean. It has a coastline of 97 km in length, and a land area of 431 km². The coastal zone, accounts for 18% (78km²) of this land area (GOB (Government of Barbados), 2001). This zone is extremely valuable to the Barbados economy, to culture and livelihoods. According to the most recent census of 2010, the population of Barbados was estimated to be 277,821. Barbados is considered to be one of the most densely populated nations in the Americas (655/km² according to the World Bank, 2011). Like most SIDS, Barbados faces extreme impacts from climate change (Simpson et al., 2010). Moreover it has been described as a climate dependent
economy (Mycoo and Chadwick, 2012). For these reasons, Barbados provides a good case for investigating DRR-CCA risk governance in SIDS. Barbados has an unprecedented accumulation of personal assets and high valued investments in vulnerable areas (UNISDR, 2013). Additionally, Barbados' unfamiliarity with a major disaster since the early 1950s until now (at the time of writing), its incapacity to finance its risk from present day hazard events, far less the expected new threats and extremes of the future (Cardona and Carreño, 2011) seem to indicate a far more risky landscape than is often suggested. Small and frequent hazard events also demonstrate the potential to cripple the country. Furthermore, that Barbados receives a high rating for governance (World Bank, 2012) does not detract from its precarious situation since 'good' governance is not necessarily an indicator of good disaster governance (Gopalakrishnan and Okada, 2007) and by extension good risk governance processes. Barbados has a central government structure and does not have a local governance structure for community governance. Given the importance of community level engagement for DRR-CCA risk governance, the case gives insight into how this could function in SIDS contexts like Barbados.

5.3. CONCEPTUAL FRAMEWORK

The Enhanced Adaptive Risk Governance (EARG) Framework for SIDS (Greenidge et al., n.d.) is used as the basis for determining whether existing DRR and CCA institutional structures and processes exhibit the potential for DRR-CCA risk governance. The EARG conceptual model builds on the Adaptive and Integrative Risk Governance model that highlights the networks, and roles of various actors governing how risk is managed, as well as the mechanisms, institutional arrangements, and processes, used in the framing of risk issues (van Asselt and Renn, 2011). These elements are reflected in the EARG approach along with specific features identified in the literature to be important in the SIDS context or for DRR-CCA integration. In summary, the EARG is supported by three principles of polycentricity, multilayeredness and multi-sectoral integration. It consists of five themes that provide the critical requirements, structures and processes for risk governance (see Figure 5-1). It consists of:

i. a development approach at different scales and over different time periods (#1),

ii. six core risk governance processes (#2) - pre-estimation, interdisciplinary estimation (including adaptive capacity), characterisation, evaluation, management, monitoring and control, and;

iii. supporting cross-cutting processes - communication, inclusion and deliberation (#3),
iv. a core systems approach (#4) that informs all processes (#2 and #3) and filters to three key sectors of development that represent the actors that should be involved in the process.

v. three pillars that support the entire framework by providing the human resources and social capital; financial and technical resources; and institutional means for an overarching joined-up governance approach (#5) that integrates and coordinates the visions, contexts, and day-to-day practice for risk governance. ‘Institutional means’ frames the supporting structures for DRR-CCA and includes the laws, norms, policies, formal and informal networks, institutional mechanisms. This is one of the main focuses of this paper.
FIGURE 5-1: ENHANCED ADAPTIVE RISK GOVERNANCE FRAMEWORK FOR SIDS
5.3.1. INDICATORS FOR DRR-CCA

Based on the EARG we now specify the indicators of DRR-CCA. First we review the indicators related to the principles of the EARG, followed by those related to the key processes. Finally, the indicators related to communication, deliberation and involvement are reviewed.

5.3.1.1. INDICATORS OF THE DEVELOPMENT APPROACH

With respect to the potential for the development approach for DRR-CCA in risk governance (#1), it is expected that development sectors such as the built and natural environment, social and economic sectors (at #5), reference the key risk governance processes (at #2) and methods for communication, inclusion and deliberation (#3), in their mandates, institutions (laws, policies, networks), protocols, budgets, and mechanisms. From a network perspective it means that these sectors are connected with each risk governance process in the network.

5.3.1.2. INDICATORS OF POLYCENTRICITY

Polycentricity may be defined as, multiple governing authorities at differing scales rather than a monocentric unit (Ostrom, 2010b, p. 552) involved in decision-making that are formally independent of each other (Ostrom et al., 1961, p.831). It is the opposite of hierarchical management and includes organisations with different structures, functions, norms, values and interests – who find ways to cooperate and coordinate their activities in order to achieve common goals (Ostrom, 2010b). In this regard, and based on Klinke and Renn (2012) we look for a mixture of state organisations, non-state organisations such as private sector, universities, and NGOs that have political authority for risk decision making. Organisation jurisdictions may overlap different scales- national, regional and community.

From a network perspective we expect therefore to find that a variety of different organisations cluster around the risk governance processes. Furthermore, the development approach to risk governance has implications for how the potential for polycentricity may be displayed. Since development sectors are expected to lead risk governance, it would therefore be expected that there would be clusters of organisations that may be from the same or interconnected sectors.
5.3.1.3. INDICATORS OF MULTI-LAYEREDNESS

'Multi-layeredness' or multilevel governance refers to the jurisdictions at which organisations involved in risk governance are operating. Some definitions of polycentricity account for this by referring to the different scales or jurisdictions at which organisations should operate. However multilayeredness also implies that organisations should provide general purpose services. The scales at which they operate should be few, non-intersecting, and fixed (durable architecture). For example, national level or regional level organisations can provide water, education and planning (Hooghe and Marks, 2003). This is the type 1 definition of multilayeredness (Hooghe and Marks, 2003). Another way that multilayeredness could be manifested is based on the tasks (type 2 multi-level governance). Jurisdictions are task-specific rather than general-purpose- meaning they are aligned with different public service industries, e.g. entity for education alone that crosses community or national scales (Hooghe and Marks, 2003). They are also intended to be flexible rather than durable and operate across numerous territorial scales simultaneously (Hooghe and Marks, 2003).

In view of these definitions it would be expected therefore that institutions examined should refer to roles for governing risk that involve organisations at different scales. Moreover, evidence of a community centred approach is sought as it augers well for DRR-CCA (Djalante et al., 2013). We also look for the role of organisations at intraregional levels (Caribbean regional organisations). From a network perspective, risk governance networks should show the engagement of actors that are at all three levels. Since the Barbados case is a central government structure, it would be expected that a significant focus on community would be expressed in national institutions. National institutions would also be dominant in the network.

5.3.1.4. INDICATORS OF THE SYSTEMS APPROACH

It is further expected that in addressing each of the key risk governance processes and subprocesses (#2 and #3) that sectors adopt a systemic approach (#4) in defining and addressing the risk problem. In this regard, institutions, and protocols for risk governance should mention approaches to address the human (socio-economic) and natural components, interactions and interconnections within their systems (and subsystems) and across other connected systems. For example the laws and policies on water management should address drainage systems but also provide for interactions with other systems such as food and tourism to be addressed (Ingram, 2011; Gain et al., 2012; Giuliani et al., 2016). Networks
should show polycentric centres that have connections with other sectors and organisations in view of the interconnections of systems and sub-systems being managed.

5.3.1.5. INDICATORS OF THE JOINED-UP GOVERNANCE APPROACH

A joined-up governance approach (#5) facilitates the systems approach. Institutions should mention approaches for sharing, within and across sectors. Partnerships should be mentioned and principles for cooperation. We look of sector policies and legislation that are integrated and approaches that can remove ambiguities or blockages for cooperation and improve the use of resources. More specifically, it is further expected that policies and plans should indicate shared purposes, values, and visions. Moreover there should be structures for planning that are multi-level, and reference cooperative funding approaches. Organisations should indicate involvement in networks or conduits for sharing ideas, and cooperation between stakeholders (Howes et al., 2015).

From a network perspective it would be expected that sharing networks as a whole should be quite dense, since there should be high social cohesion because of the smallness context. In addition, it is expected that sharing networks should go beyond just sharing existing information, which is defined here as the use or provision of information; and rather exhibit collaboration. This means that there is indication that new information is generated, and organisations work together (on a formal or semi-formal basis) on projects, developing joint initiatives, plans, policies or procedure. We expect that there would be more organisations that exhibit collaboration as opposed to sharing information only, given the higher ease that is expected of accomplishing this in a small context. Sharing networks for collaboration should be dense and show strong connections or ties between each other. This may be demonstrated by the frequency of the type of collaboration whether infrequent, periodic or frequent. Networks should have key agents for sharing.

In the following sections the indicators are presented on the potential for integration from the perspective of the key processes, communication, deliberation and inclusion.
Table 5-1 shows the key processes and their associated sub-components. Each key process (shown as #2 of Figure 5-1) is vital to a DRR-CCA risk governance approach and as such it is expected that the institutional structures and networks for key sectors refer to each of these areas. To this end, there should be comprehensive inclusion of these processes in institutions-mandates, laws and policies. For example, if organisations are not undertaking the pre-estimation stage, then early detection of climate change risks is missed and integration potential is overlooked here. Similarly, if components of the interdisciplinary estimation approach are lacking, in particular where vulnerability assessment is under-represented, this creates a major challenge for the DRR-CCA approach. It could mean that shifting baselines have not been considered in the vulnerability assessment and therefore resultant management options could very well be mal-adaptive or faulty because the information source is incomplete.

**TABLE 5-1: RISK GOVERNANCE KEY PROCESSES. MODIFIED FROM GREENIDGE ET AL., N.D.; RENN AND KLINKE, 2013**

<table>
<thead>
<tr>
<th>Pre-estimation</th>
<th>1) Framing possible hazards, potential impacts (risks) or problems of concern 2) early warning of new and emerging threats as well as monitoring new and reoccurring ones, 3) prioritising and 4) determining procedures for the overall governance process.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interdisciplinary estimation</td>
<td>1) Hazard analysis, 2) exposure assessment of people, physical and environmental assets, 3) risk estimation that includes a systems focused vulnerability assessment, perceptions assessment as an amplifier or attenuator of risk; concern assessment and; adaptive capacity assessment.</td>
</tr>
<tr>
<td>Characterisation</td>
<td>Compiling the evidence base from scientific inquiry by profiling the hazard, making a judgment on the seriousness of the risk, and identifying the potential options for handling the risk.</td>
</tr>
<tr>
<td>Evaluation</td>
<td>Making judgments about whether risks should be accepted (do nothing), tolerated (addressed) or totally avoided (intolerable); and whether risk reduction measures are needed.</td>
</tr>
<tr>
<td>Management</td>
<td>1) Generating options for handling the risk such as prevention or mitigation measures or risk transfer options, 2) investigating the impacts of the trade-offs of benefits vs. the costs. 3) implementing the preferred option/s.</td>
</tr>
<tr>
<td>Monitoring and Control</td>
<td>Making observations and evaluating the effects of implemented risk management measures. It includes feedback from risk management practice.</td>
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</tbody>
</table>
5.3.3. COMMUNICATION, DELIBERATION AND INCLUSION INDICATORS

Communication, deliberation and involvement are vital sub-processes (theme 3 in Figure 5-1) that influence the effectiveness of the key processes, as well as enable the joined-up governance approach.

5.3.3.1. COMMUNICATION INDICATORS

From the perspective of communication specifically, it would be expected that policy and institutions reference information sharing, and interfaces for sharing. The means for communicating throughout the risk process to the media and public should be mentioned. Additionally science policy sharing platforms, and awareness building campaigns should be stated. There should also be an indication of the sources and kinds of information that may be shared. Mauelshagen et al., (2014) and Renn, (2008) provide baseline guidance on this. The way in which sharing takes place is also essential and so we look for a number of modes based on Renn (2008). Sharing may be informal or formal (Mauelshagen et al., 2014) and can include, public meetings, informal discussions, and meetings. We also look at the different modes of sharing and look for possible drivers promoting sharing and collaboration. Mauelshagen et al., (2014) suggests that a culture of collaboration is a top factor in promoting knowledge transfer. Furthermore, person-person agreements can have a role (Mauelshagen et al., 2014). We also look for formal policies for sharing, access to funding, as well as the indication of sharing mechanisms or networks which could hinder sharing (Mansourian et al., 2006; Joshi et al., 2010; Mauelshagen et al., 2014; Papathoma-Köhle et al., 2016; Ran and Nedovic-Budic, 2016).

5.3.3.2. DELIBERATION INDICATORS

Deliberation is enabled through communication, it refers to the, ‘style and nature of problem solving through communication and collective consideration of relevant issues’ (National Research Council, 1996 p. 73). A number of indicators can be identified to show the extent of deliberation or participation (Renn, 2008). On this basis, we look for agreement from participants that there is transparency, competence, fairness, efficiency, a clear mandate, diversity, and professionalism in the risk governance process. Table 5-2 provides further details on each feature. In addition, it is expected that participants refer to and are satisfied with various modalities for deliberation such as round tables, open forums, advisory committees that would allow for discussion of competing arguments, beliefs, and values and ascertain the views of participants and stakeholders (Renn, 2008).

<table>
<thead>
<tr>
<th>Feature</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Transparency</td>
<td>The way in which stakeholders are selected to participate and how their views are considered is documented. There should be full understanding of all process steps, procedures for communication and methods such as for reaching agreement.</td>
</tr>
<tr>
<td>2. Competence</td>
<td>The state of art of knowledge on the risk issues is considered in discussions and all participants are made knowledgeable in the issue and can apply the deliberative approach in the process.</td>
</tr>
<tr>
<td>3. Fairness</td>
<td>There is adequate representation of constituents in the participatory process and equal opportunity for input.</td>
</tr>
<tr>
<td>4. Efficiency</td>
<td>Resources for participatory activities are balanced with that of the envisioned outcome. Participatory methods are cost-effective.</td>
</tr>
<tr>
<td>5. Clear Mandate</td>
<td>There is a clear understanding of expectations of the participatory process, duration of the process, scope of options to be considered, and nature and future use of outcomes from the deliberations.</td>
</tr>
<tr>
<td>6. Diversity</td>
<td>Multiple perspectives and disciplines that have bearing on the risk of interest are included.</td>
</tr>
<tr>
<td>7. Professionalism</td>
<td>The process is structured, moderated and facilitated, and results are shared.</td>
</tr>
</tbody>
</table>

5.3.3.3. INCLUSION INDICATORS

Small size allows for power of agency at the local and national level to be amassed and seems to promote social cohesion (Blancard and Hoarau, 2013) and high social capital. Social capital, is defined as networks and relationships between individuals and social groups that facilitate economic well-being and security (Adger et al., 2004 p.35). It is therefore expected that there would be better inclusion in practice, as demonstrated by a highly dense network for communication. It is anticipated that relevant knowledge, actors and stakeholders from the various sectors (according to the EARG) are involved in the respective risk governance.
processes. Focusing on communication it should be expected that there are ties or connections that link all actors to the network and that each decision centre benefits from knowledge on all areas of risk governance. There should also be limited marginalisation of actors in the risk governance decision-making process. Actors may be from the state, social (NGOs and representatives of vulnerable groups) and the market (risk insurance) (Forino et al., 2015). Their engagement may be referenced in institutions that may address their interactions with each other which may be via co-management, public private partnership or private social partnership arrangements (Forino et al., 2015).

In the following sections we review how these indicators were applied and the methodology applied.

5.4. METHODOLOGY

We applied a case study methodology (Yin, 2003) through which a mixed methods approach was applied to collect data and analyse the findings on the extent to which existing DRR and CCA institutional structures and processes exhibited the potential for integrated risk governance. To address the question on the potential ‘in principle’ we collected data from documents. Secondly data on integration ‘in practice’ we collected data from surveys. Document analysis was used to establish the current policy and practice landscape around DRR and CCA risk governance. Social Network Analysis (SNA) was used to understand the networks around risk decision-making in these areas. Table 5-3 summaries the key questions and which method of analysis was applied to investigate the potential for integration against the three broad themes of the EARG conceptual framework- 1) critical requirements, 2) key processes, 3) communication, inclusion and deliberation.
<table>
<thead>
<tr>
<th>1. CRITICAL REQUIREMENTS</th>
<th>Key Questions</th>
<th>Method of Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Development Approach</td>
<td>How is risk governance incorporated in sector mandates, and institutions (laws, norms, policies, networks)?</td>
<td>Document Analysis</td>
</tr>
<tr>
<td>Polycentricity</td>
<td>How do networks derived from institutional networks show polycentricity? To what extent are the process networks, polycentric-organized around particular focal/sector organisations or processes?</td>
<td>Document Analysis Social Network Analysis (SNA)&lt;sup&gt;8&lt;/sup&gt;</td>
</tr>
<tr>
<td>Multi-layeredness</td>
<td>How do risk governance institutions address various scales - at the national, community and sub-regional level? How well represented are the different scales of organisations in the network? How do specific task specific organisations function across different scales?</td>
<td>Document Analysis SNA</td>
</tr>
<tr>
<td>Systemic approach</td>
<td>How are systems and their subsystems identified for risk governance? How are human and natural components and interactions of the systems accounted for during risk governance?</td>
<td>Document Analysis</td>
</tr>
<tr>
<td>Joined-up and network approach</td>
<td>How are integrated legislation, shared policies, multi-level planning, networking organisations, cooperative funding, and sector coordination addressed? How strong are network connections (tie strength)? To what extent can sharing agents/brokers function in the network?</td>
<td>Document Analysis SNA</td>
</tr>
</tbody>
</table>

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<sup>8</sup> SNA stands for Social Network Analysis
<table>
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<tr>
<th>2. KEY PROCESSES</th>
<th>Key Questions</th>
<th>Method of Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 main themes</td>
<td>To what extent are the 6 main themes (section 5.3.2) present in policies and institutional structures? To what extent are the themes represented in practice networks?</td>
<td>Document analysis Social Network Analysis</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3. Communication, inclusion, and deliberation</th>
<th>Key Questions/Indicators</th>
<th>Method of Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Communication:</strong> How is communication addressed in policies and other institutional structures?</td>
<td>Document analysis</td>
<td></td>
</tr>
<tr>
<td><strong>Deliberation:</strong> How satisfied are participants with the modalities for deliberation? (Renn, 2008)</td>
<td>Descriptive statistics</td>
<td></td>
</tr>
<tr>
<td><strong>Inclusion:</strong> To what extent are relevant knowledge, actors and stakeholders included in the risk governance network? To what extent are there dominant or peripheral organisations?</td>
<td>Document analysis SNA</td>
<td></td>
</tr>
</tbody>
</table>

---

**5.4.1. DOCUMENT ANALYSIS**

Document analysis (Bowen, 2009) was carried out on documents that were mainly available online. In most instances, the documents were available from the organisation of interest website or the Parliament of Barbados website. In total 13 documents were collected on key national and regional legislation, policies, strategies and plans on risk governance in Barbados Table 5-4. Care was taken to select nationally or regionally approved documentation that gave details on the EARG's main themes and sectors and that would be representative of the national approach. The document analysis focused on a search for content related to five pre-identified themes of integration as shown in Table 5-3. These were applied to code and cross examine the documents selected.
### TABLE 5-4: KEY DOCUMENTS COLLECTED

<table>
<thead>
<tr>
<th>Legislation and Policy</th>
<th>Focus</th>
</tr>
</thead>
<tbody>
<tr>
<td>6. Soil Conservation (Scotland District) Act, Cap 396 (1998a)</td>
<td>Landslide management and planning</td>
</tr>
<tr>
<td>8. Coastal Zone Management Act, Cap 394 (1998a)</td>
<td>Coastal management</td>
</tr>
<tr>
<td>12. Caribbean Community Climate Change Centre (CCCCC) Policy and Plan (2011)</td>
<td>Regional climate change adaptation strategies</td>
</tr>
<tr>
<td>13. Draft Climate Change Policy (unpublished)</td>
<td>National climate change adaptation structures and arrangements</td>
</tr>
</tbody>
</table>

---

### 5.4.2. SOCIAL NETWORK ANALYSIS

Social network analysis (SNA) was undertaken in addition to document analysis, in order to further understand the DRR-CCA potential from the perspective of the practice networks.

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### 5.4.2.1. DATA GATHERING

Data on DRR and CCA in practice was gathered through a questionnaire designed to capture network characteristics of actors involved in DRR and CCA in Barbados, following Borgatti, Everett and Johnson, (2013) and a survey from the Climate Just project on CCA (Climate Just, 2014b). Participants were selected that could represent, different types of actors - state, social...
(two Non-Governmental Organisations), market actors (Forino et al., 2015) and sectors of the EARG. See Table 5-5 for the list of actors. A snow ball approach (Donley, 2012) was applied to establish the bounds of the network of actors. In order to establish the importance of participating in the study, participation was invited through the auspices of the Department of Emergency Management. The questionnaire was administered mainly online and provided data from 15 organisations. It was also administered in person as a matter of convenience for 10 core CCA and DRR risk governance organisations. Based on the experience of the researcher and positionality as a Barbadian, and former regional and national technocrat, further data for the risk governance network was included on 10 other organisations that were named but who did not participate in the questionnaire. In total data was collected from 35 organisations.

### Table 5-5: List of Actors

<table>
<thead>
<tr>
<th>Type of Organisation</th>
<th>Organisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market</td>
<td>1) Barbados Chamber of Commerce and Industry (BCC) 2) Barbados Light and Power (BLP) 3) General Insurance Association of Barbados (GIAB) 4) Barbados Association of Professional Engineers (BAPE)</td>
</tr>
<tr>
<td>Social</td>
<td>5) Barbados Red Cross (BRC) 6) Future Centre Trust (FCT)</td>
</tr>
</tbody>
</table>

*Bolded names are those organisations whose SNA data was provided by the researcher*

All participants provided consent for their responses to be recorded. Full ethical procedures were adhered to so that prior to data collection, participants were fully briefed on the study and given the opportunity to withdraw should it be their desire.

Survey questions provided information for the analysis of the key process and communication networks (Table 5-3). They also provided data for descriptive statistics on the potential for deliberation based on the participant’s perceptions of deliberation features (Table 5-2) on the Likert scale. The survey was tailored to layman references to CCA and DRR. It therefore asked about the organisation’s climate related work and how climate change was incorporated in their work. The survey was mostly structured, for example, participants were asked to select the work that they engaged with from a drop-down list of 15 categories that reflected the five simplified risk governance categories: pre-estimation; interdisciplinary estimation, evaluation, management and communication. Not all of the elements were explicitly covered, e.g. exposure assessment or characterisation, in order to avoid participant fatigue. However, participants were given the opportunity to suggest any additional categories, elements or issues which they felt were important. Since follow-on components of the survey on communication, inclusion and deliberation were linked to the key processes selected, responses were validated through a descriptive question on the work they did. Unrelated risk governance themes, such as responding to emergencies, rebuilding and recovery, and ‘nothing’ were included in the list of 15 categories. This was a means for capturing basic information on the types of activities from organisations that should have a role in the risk governance network. Nothing further was asked if only these categories were selected.

Survey questions on the communication network potential were gathered through a matrix format of questions (Borgatti et al., 2013) with drop down options on-which organisations they had connections with. This included information on the type of relationship- information
sharing vs. collaboration and further indication of the strength of the relationship (irregular, periodic, frequent) for information on the joined-up governance potential.

5.4.2.2. DATA ANALYSIS

Social Network Analysis (SNA) is a mathematical approach that allows for a study and analysis of the 'structures of relationships' amongst the various actors for DRR and CCA risk governance processes (Wasserman and Faust, 1994; Borgatti et al., 2013). It is often used in connection with other types of analysis to give deeper understanding of relationships. NetDraw (Borgatti, 2002) was used to generate graphs of the social network of organisations involved in risk governance activities, and their communication networks. The network was understood to represent for the most part a whole network of organisations that were identified to be communicating information related to DRR and CCA risk governance in Barbados. The SNA was applied to provide information on potentials in practice for multi-layeredness, polycentricity, joined-up governance, key processes, communication and inclusion (Table 5-3). The SNA provided a number of measures to analyse the potential of these features (Table 5-6).

Graphs were generated by providing numerical codes for the key activities identified, which were collapsed as necessary, and compiled into one matrix of all responses from organisations. Organisation names were also coded (35). This was used to generate a two modal network graph (Borgatti et al., 2013) that showed connections between all organisations and their respective risk governance activities (key processes in Table 5-1). A second graph was generated by creating a matrix of all organisations and the coded connections that exist between them; the focus was only on whether there was a connection or not. In this regard, this second graph represented an undirected graph of connections amongst risk governance organisations in DRR and CCA. This graph also represented networks for collaboration and information sharing. This was based on coded data and connections amongst organisations which were associated with each category (collaboration and information sharing) and 3 numerical codes on the strength (irregular, periodic, frequent) of these connections. Seven measures were used to analyse the network integration potential: density, clustering, cliques and K-cores and 3 centralisation measures- Degree Centrality, Betweenness and Closeness. See Table 5-6 on what these measures are and how they were applied.
<table>
<thead>
<tr>
<th>DRR-CCA Attribute</th>
<th>Network Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Polycentricity and the development approach</strong></td>
<td>Degree Centrality - compares the number of ties a node/organisation has compared to others, it is the ratio between the numbers of links for each node divided by the maximum possible sum of differences. A polycentric network should have a number of organisations with high centrality scores. High centrality should correspond with key development sectors. A number of Clusters, Cliques or core groups should be associated with sector groups for risk governance. The graph should be cluster like and not hierarchical. Cliques may be based on k-cores which in an undirected graph is a connected maximal induced sub graph which has minimum degree greater than or equal to k. K-Cores are not necessarily cohesive subsets but they do identify areas of the graph which contain clique like structures (Seidman, 1983)</td>
</tr>
<tr>
<td><strong>2. Multilayeredness</strong></td>
<td>Clusters should consist of organisations at the different levels-community, national and regional.</td>
</tr>
<tr>
<td><strong>3. Joined-up governance potential (Co-creation of Knowledge, collaboration)</strong></td>
<td>Tie Strength between organisations. Closeness - the degree with which an entity is nearer to all others in a network either directly or indirectly. It further reflects the ability to access information through the network members) (Ghali et al., 2012). Almost all organisations should be close to each other. As such it seems they should have similar closeness scores. Density - is measured on a scale of 0-1, the closer to one the more connected the network is. A density score close to one is expected (Borgatti et al., 2013). Betweenness - is the degree to which a node lies between other nodes in the network. It considers connectivity of the node’s neighbours in order to provide a higher value for nodes which bridge clusters. This metric reflects the number of people who are linking indirectly or directly. To this end, the betweenness of a node, measures the extent to which an organisation (represented by a node) can play the part of a broker in the network. It is expected that there are a number of organisations that show high betweenness and could act as brokers.</td>
</tr>
<tr>
<td><strong>4. Inclusiveness</strong></td>
<td>Clusters, cliques or core groups are identified that engage all sector organisations in risk governance.</td>
</tr>
</tbody>
</table>
5.5. RESULTS

In this section, the findings on the potential for integrated risk governance in principle and in practice are presented. We first discuss the extent to which the potential related to critical requirements such as a development approach to risk governance, the systemic approach and also a joined-up government and network approach were found. Thereafter we discuss the network findings concerning the key processes, communication, deliberation and involvement.

5.5.1. DRR-CCA POTENTIAL ‘In PRINCIPLE’

5.5.1.1. CRITICAL REQUIREMENTS

A. DEVELOPMENT POTENTIAL THROUGH BROAD POLICIES, AND IN-ROADS IN THE BUILT AND NATURAL ENVIRONMENT SECTORS THOUGH LIMITED BY DISPARITIES IN THE SOCIO-ECONOMIC SECTORS

In line with required indicators for the development approach, references to risk governance processes were found in a number of institutions/laws and policies, though in most cases risk governance was not explicitly stated but could be inferred (Appendix 12) provides a summary). Policies were mostly at the national level, and included some supporting risk governance institutions at the intra-regional level. With the exception of the Barbados Growth and Development Strategy and the Emergency Management Act that addressed, climate change and disaster risk respectively, institutions did not necessarily identify these areas as the specific focus of policy. Particular potential however exists in that many laws and policies seemed broad enough for application to both climate change and present risk. For example, Acts and plans related to the built and natural environment sectors such as the Coastal Zone Management Act could address all aspects of risk governance, It aims ‘to provide for the more effective management of the coastal resources of Barbados, for the conservation and enhancement of those resources and for matters related thereto, Research, standards, assessments, preservation, conservation, enhancement, EIAs (GOB (Government of Barbados), 1998a). In contrast, the Physical Development Plan explicitly stated that it seeks to, plan, develop and manage settlement and land use systems in a manner which takes into account risks of natural and man-made disasters and coastal erosion (GOB (Government of Barbados), 2003).

Findings highlighted that, most institutions for risk governance were related to the natural and built environment. In contrast, institutions for other sectors such as the social and economic sectors showed some potential but were limited. Some examples could be found for
risk governance application in the water and health sectors, which are both related to the social sector, but, other key social institutions related to culture and poverty alleviation aspects which are imperatives for addressing vulnerability in SIDS were weak. Only two institutions addressed risk governance explicitly and the coverage given was not encompassing of the sector requirements. For example, culture was addressed only through preservation of cultural heritage through development control, in the Town Planning Act (GOB (Government of Barbados), 1998d); and the poor are addressed in the strategy to build climate change resilience in the Barbados Growth and Development Strategy 2013-2020 (GOB (Government of Barbados), 2013a), which only mentions a holistic approach to tackle vulnerabilities including support to the poor. From an economic sector perspective, while legislation was limited, potential was shown. Particularly in the agriculture sector, there was legislation that addressed soil erosion control (GOB (Government of Barbados), 1998c). From an economic sector perspective, there was a policy that applied a risk transfer approach as part of the risk management strategy. The policy insured assets through a regional, parametric risk-pooling facility called the CCRIF SPC (Caribbean Catastrophe Risk Insurance Facility, Segregated Portfolio Company) (CCRIF SPC, 2015). Regardless of these highly prospective entry points for DRR-CCA integration in the economic sector, key sectors such as tourism and fisheries did not seem to have applicable institutions for risk governance. In section 5.5.2 how these findings differed in practice are discussed.

B. POLYCENTRICITY- STATE CENTRED

Figure 5-2 shows the framework for DRR and CCA risk governance derived from the institutions reviewed. Bolded organisations are those that overlap both DRR and CCA. This is further discussed at section 5.5.1.2 on ‘inclusiveness’. We found that in principle, DRR and CCA risk governance was state-cantered rather than polycentric. A four part structure was apparent that included the DEM led Emergency Management Advisory Council (EMAC) in the Ministry of Home Affairs structure- national emergency management system, 2) the Policy and Planning Research Unit led National Climate Change Committee in the Ministry of the Environment and Drainage, 3) the individual agency mandate driven structure at the national level and 4) agency mandate structure at the intraregional level with mandates, policies or legislation for risk governance. It would be interesting to see whether in practice there were other centres for decision-making.
FIGURE 5-2: STRUCTURE FOR DRR AND CCA RISK GOVERNANCE IN BARBADOS - AUTHOR’S DIAGRAM
C. MULTI-LAYEREDNESS - STRUCTURAL PRESENCE OF ALL LEVELS BUT LIMITED BY AN UNDER-DEVELOPED THE COMMUNITY LEVEL

There seemed to be high potential for multi-layeredness, since all three layers of the EARG were reflected - community, national and intra-regional (Figure 5-2). Organisations were heavily focused at the national level, with some engagement with community and at the intra-regional level. As Barbados is a member of the Caribbean Community (CARICOM) it participates in several intra-regional Caribbean organisations. These include agencies with disaster management and climate change mandates such as the Caribbean Disaster Emergency Management Agency (CDEMA) and the Caribbean Community Climate Change Centre (CCCCC) respectively. The legislative mandates of these organisations facilitate support to DRR and CCA at the national level through their requisite focal points - DEM and Ministry of the Environment respectively. In addition, each organisation may provide direct DRR and CCA inputs to the governance process as members of committees, conduits of information and policy advice or as supports for institutional strengthening.

Notwithstanding the potential shown through engagement of each level, there seemed to be some inconsistencies at the community level that could minimise the potential for multi-layeredness. Given Barbados’ central governance system, national level operation was associated with the community, it therefore seemed that this level was also well established. Furthermore, there was a DRR community structure that engaged 30 district emergency organisations (DEOs) for each electoral district. This therefore suggested a deepened community focus. Nevertheless, the potential shown here seemed limited since the DEO legislation was out-dated and addressed preparedness only. Other community institutions that could be associated with the community focus approach such as recently formed community development or the constituency councils’ legislation did not address risk governance. Furthermore no similar structure was found for climate change adaptation.

D. JOINED-UP GOVERNANCE POTENTIAL FOR MULTILEVEL PLANNING BUT MINIMISED BY MISSING PROTOCOLS AND CONNECTIONS

We looked for evidence of shared policies (purposes, values, visions), multi-level planning, integrated legislation, networking or cooperative organisations. There seemed to be some potential for joined-up governance based on an overarching institution for risk governance. Namely the Emergency Management Act (2006) (GOB (Government of Barbados), 2006). The Act gives the authority for coordinating comprehensive disaster management which includes DRR, to the DEM specifically (Figure 5-2); however it also empowers an inter-sectoral
committee, the Emergency Management Advisory Committee (EMAC) with ministerial authority, and policy and planning roles for emergency management which includes DRR. Explicit risk assessment roles are assigned through the EMAC structure to two committees-the Technical Standing Committee on Coastal Hazards and a National Hazard Mitigation Committee. One challenge however is that the Act does not specifically incorporate climate change, though since comprehensive disaster management promotes an all-hazards, all-sectors approach, in principle it could address climate change. The potential for a joined-up approach may however be limited by the silence of the Act on the roles of organisations for the coordinated approach.

Networking is a key indicator that we looked for in identifying the joined-up governance approach. There was evidence of a plethora of organisations networking within groups of the multi-level structure. These included the EMAC and the Climate Change Committee (Figure 5-2). However, it seemed that missing ministerial, and cross committee connections in the risk governance structure could challenge the networking potential. Furthermore, DRR and CCA were also being advanced under two different ministries, under separate structures with minimum linkages between the two. Linkage was facilitated through one central agency- the DEM, through its participation in committees across the 2 main structures. This arrangement for cross-linking was not common otherwise and seemed that it could weaken the networking potential. It will be interesting to see how this was operating in practice.

E. SYSTEMIC APPROACH- LIMITED POTENTIAL
There was no evidence in the legislation and policies reviewed, that a systemic approach that accounted for systems or sub-systems interactions as part of risk governance was operating. Nonetheless it could not be concluded that the systemic approach was totally absent since there seemed to be some hint of addressing interlinked vulnerabilities that could imply a systemic approach. For example this is done in the Barbados Sustainable Development Growth Strategy.
5.5.1.2. PROCESSES IN PRINCIPLE

A. KEY PROCESS COVERAGE

We found that institutions mainly focused on the final step of the risk governance process, risk management, with limited attention to the other key processes of risk governance. Key processes related to pre-estimation, and risk estimation such as vulnerability assessment, characterisation and monitoring were not specified. In summary, there was not comprehensive treatment of all the steps of the risk governance process in sector Acts thus demonstrating weak potential for integration.

B. INCLUSIVENESS POTENTIAL AT THE RISK OF DUPLICATION AND SEPARATION

Based on the indicators of inclusion concerning the incorporation of relevant knowledge, actors and stakeholders in the risk governance network, there seemed to be potential for DRR-CCA. Figure 5-2 shows the plethora of organisations that included representatives of the EARG sectors across both DRR and CCA structures. Specifically for, 1) the building and natural environment sector- disaster management, building, environment, planning 2), social sector- water, health, social care and 3), economic sector- business, tourism, utilities, and economics. Notwithstanding the high level of inclusion, there also seemed to be a high level of duplication in the DRR and CCA systems which operated in parallel to each other. Bolded organisations in Figure 5-2 are those that overlap both DRR and CCA. For example, Agriculture, Meteorological Services (Met), Disaster Management, and CZMU, Planning (TCP), Drainage (DD), Health (MOH) and Environment were involved in both systems. Alternatively there were key agencies involved in the DRR system but not the CCA system and vice versa. For example, the EMAC structure did not include many environmental, economic and ‘business’ sectors participants, including energy and water; and the climate change structure did not engage many social sector and ‘defence entities’.

5.5.2. DRR AND CCA RISK GOVERNANCE - POTENTIAL IN PRACTICE

Having reviewed the document evidence that we found for DRR-CCA potential in Barbados, we turn to the evidence found in practice networks that was derived from the surveys. Surveys suggested that most organisations (80%) were incorporating climate change in the processes they were undertaking; though the full extent to which this was being done was not determined. Notwithstanding, as reported the data generated from the networks was understood therefore to represent DRR-CCA networks for risk governance.
The following section presents further findings on the indicators of polycentricity, multilayeredness, joined-up potential (including collaboration), inclusiveness and deliberation from a practice perspective. First, the findings associated with the analysis of the two network graphs generated are presented: 1) undirected graph of connections amongst risk governance organisations in DRR and CCA related to collaboration and information sharing (Figure 5-3); and 2) a two modal network graph that shows connections between all organisations and their respective risk governance activities (Figure 5-5). We conclude with survey perception data on deliberation.

5.5.2.1. PRACTICE NETWORK

A. POLYCENTRICITY AND DEVELOPMENT APPROACH - PRESENT BUT LOW SPREAD

Figure 5-3 shows the undirected graph of sharing connections amongst DRR and CCA risk governance organisations. With respect to the potential shown for polycentricity, we expected high centrality scores to be associated with the key sector leads, for the built and natural environment, social and economic sectors. We found some examples of this particularly in the built and natural environment sector. There were a number of organisations from this sector that had a high ratio of links to other organisations compared to the maximum links possible. These organisations included the Ministry of the Environment (MOE), MET, BWA and Drainage that had similar high centrality scores. From a social perspective however, the DEM received by far the highest score (0.405). This seemed to point to some level of hierarchy however since others did not have a similar score of centrality. The high connectedness of the DEM in the framework seemed to complement the findings of its centrality, or high connection with other organisations that was found in the document analysis. There were also supportive organisations such as the Statistical Department that received notable centrality scores (0.271) compared to others. There seemed to be some polycentricity displayed by coastal sector leads such as the CZMU as well as for the tourism sector. Very low centrality scores were associated with defence entities usually associated with disaster response and community organisations and groups such as DEOS. In summary, the potential for polycentricity seemed to be mostly in the natural and built environment sectors. See Figure 5-4 for a summary of the centrality scores.
Figure 5-3: The risk governance network of organisations. Organisations are coloured by clusters and shaped by level of operation.
Analysis of centrality from the perspective of participation in risk governance processes (Figure 5-5), confirmed that the CZMU was a highly central actor but also revealed a number of other central actors. Although CZMU was the most central actor, in contrast, the disaster management lead organisation, DEM, displayed a much lower level of centrality. Furthermore the Environment Ministry did not emerge to be polycentric in the case of the sharing network. However, other development actors such as the Drainage Division (related with the water sector) emerged as a central actor. It was highly involved in the various risk governance processes. In addition, a regional organisation, the Caribbean Institute for Meteorology and Hydrology, that could be associated with supporting a number of development sectors emerged to be highly central.

Further analysis of polycentricity seemed to suggest that some organisations’ clustering corresponded with the development sector approach (Figure 5-5). Figure 5-5 shows organisations with similar activities of engagement clustering together.
<table>
<thead>
<tr>
<th>LEGEND</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Activity</strong></td>
<td>The size of the squares represents the number of organisations doing that activity.</td>
</tr>
<tr>
<td><strong>Organisation</strong></td>
<td>The size of the circles represents the number of risk governance activities that organization is involved in.</td>
</tr>
</tbody>
</table>

- Hazard Analysis (Interdisciplinary estimation- IE) **A3**
- Vulnerability Assessment (IE) **A4**
- Perceptions (IE) **A5**
- Procedures for criteria screening, assessing and managing hazards and risks (Pre-estimation) **A9**

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**FIGURE 5-5: CONNECTIONS BETWEEN RISK GOVERNANCE ACTIVITIES AND ORGANISATIONS (DISPLAYED USING A UCINET MATHEMATICAL PROJECTION)**
The cluster to the right of graph consists of the built and natural environment sector actors. It includes the coastal zone management unit, town planning, ministry of environment, the meteorological services and the University. This cluster could also represent for the most part the members of the planning process. Their centrality scores seemed to suggest a number of polycentric centres that were overlapping. We did not find similar associations (by development sector) for other sectors. For example whilst there was one other distinctive cluster such as the one to the far extreme of this group, that mainly consisted of social sector organisations such as the DEO groups, welfare, the Red Cross, and, housing for example it was not applicable to risk governance polycentricity since they clustered around response rather. In addition the group on the periphery was a mixed group of organisations with very low centrality scores from the built and natural environment- engineers association, and environmental protection; and the economic sector- standards institute, and insurance.

The clique analysis should have highlighted polycentricity; however it showed few indications for the sector development approach to the formation of cliques and for polycentric centres. Cliques were not associated with sectors as expected but seemed to provide information on levels of inclusion (which is discussed in section B). An exception to this was the social sector, which had a clique of 2 organisations.

B. INCLUSIVENESS- A CORE GROUP BUT LIMITED BY SOCIAL SECTOR UNDERREPRESENTATION AND ECONOMIC SECTOR DISPARITIES

The practice networks did not show the same potential for integration as suggested in principle from the perspective of inclusiveness. This is because while there seemed to be a dense network of risk governance actors, several sector actors seemed to be underrepresented or excluded from the risk governance process; particularly those in the social and economic sectors respectively (Figure 5-3 and Figure 5-5). For example, the Ministry of tourism, a key economic sector organisation showed low centrality and other organisations such as those in investment, excluded themselves by stating that they did not have a role or as in the case of commerce simply did not respond to the survey. This would imply weak economic sector involvement. Social sector organisations such as social care, was also underrepresented in the process. Moreover, non-governmental organisations were missing from the structure possibly indicating weak social engagement with risk governance.
The results of the clique analysis (Table 5-7)—grouped according to similar connections also seemed to support the varying degrees of inclusion shown in the centrality assessment. It suggested that they were five core cliques. The first group seemed to be those who have a nominal connection with others for risk governance, such as the Engineers Association and Environmental Protection. The second group however, seemed to be those more involved in risk governance. Although tourism is not very involved it has similar connections as others in the group who are more involved. Social sector organisations seemed to link with each other in the fourth group therefore possibly suggesting the similarity in low involvement in the risk governance process. The fifth clique of actors (13 organisations), consists of community groups, environmental NGOs, social sector, response (police, and fire) and economic organisations (commerce) including insurance organisations. This group seemed to correspond with those that were not well connected in the risk governance process. There seemed to be some level of distinction displayed by regional organisations as they were all assigned to the same clique (group 3).

**TABLE 5-7: TABLE SHOWING CLIQUES**

<table>
<thead>
<tr>
<th>Clique No.</th>
<th>Organisation</th>
<th>Possible representative group</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Barbados Association of Professional Engineers (BAPE), Barbados National Standards Institute (BNSI), Environmental Protection Department (EPD)</td>
<td>Fringe mixed quasi-government and NGOs</td>
</tr>
<tr>
<td>2</td>
<td>Government Information Service (GIS), Ministry of Tourism (MOT), Lands and Surveys (LS), Ministry of Transport and Works (MOTW), Barbados Statistical Service (BSS), Ministry of the Environment (MOE), Drainage Division (DD), Coastal Zone Management Unit (CZMU), Department of Emergency Management (DEM), Barbados Water Authority (BWA), Barbados Meteorological Services (MET), Ministry of Health (MOH), Town and Country Development Planning Office (TCDP)</td>
<td>Core state participants</td>
</tr>
<tr>
<td>3</td>
<td>Caribbean Disaster Emergency Management Agency (CDEMA), Caribbean Institute for Meteorology and Hydrology (CIMH), University of the West Indies (UWI)</td>
<td>Regional agencies</td>
</tr>
<tr>
<td>4</td>
<td>Ministry of Social Care (MOS), Welfare Department (WD)</td>
<td>Social sector</td>
</tr>
<tr>
<td>5</td>
<td>Barbados Defence Force, Community Constituency</td>
<td>Response</td>
</tr>
</tbody>
</table>
C. MULTI-LAYEREDNESS- PARTICIPATION ACROSS LAYERS

With respect to the potential displayed for multi-layeredness, there was high correspondence of the findings in principle with those in the practice networks. National organisations were highly active in the networks and worked also at the community level. See Figure 5-3 (different shapes correspond with those organisations working at different levels). In addition, regional organisations were highly active in the network such as the Caribbean Institute for Meteorology and Hydrology (CIMH) but not the regional disaster agency (CDEMA). It was found however, that the layer of those organisations working mainly at the community level such as DEOs, the Ministry of Social Care, Welfare Department, and the Future Centre seemed to be weakly linked to the core structure. From a risk process network perspective (Figure 5-4) while the network showed potential across the multiple layers, there seemed to be no participation of community level representatives like the DEOs and constituency councils. Findings on the linkages across the layers would also help to suggest the potential for integration displayed.

D. JOINED APPROACH POTENTIAL- BROKERS, FOCAL POINTS AND HIGHLY CONNECTED

I. BROKERS- FEW BROKERS THOUGH A SMALL CONTEXT

Based on indicators of the potential for a joined-up approach, it was expected that there would be several organisations that facilitated linking and sharing with other organisations directly or indirectly. Betweenness scores gave insight as to which organisations were providing this role- organisations with higher scores could be understood to be the key brokers in the network (Figure 5-4). We found three possible organisations that seemed to display this brokering potential. In particular the disaster management lead, the DEM (21.048) and two other less connected but essential brokers in the social sector- the Welfare Department (8.082) and the Ministry of Social Care (6.952). The brokers are instrumental in providing essential linkages to actors however the potential of the social sector seemed
challenged since they were not strongly involved in the risk governance process. DEM was involved in a number of areas that included framing, monitoring, addressing impacts, and building awareness. It was also interesting that though the Ministry of the Environment (1.887) in principle (at section 5.5.1) seemed to have a brokering role in practice it however did not emerge as a broker, this would have implications for the effectiveness of structures in principle that were positioned to address climate change. In fact, the network had few brokers despite the small context.

II. COLLABORATION FOCAL POINTS BUT LOW SPREAD WITH LIMITED SCIENCE POLICY POTENTIAL

With respect to another indicator of the joined-up approach, collaboration, we expected that there would be high collaboration due to assumed high social cohesion and smallness in SIDS. Based on the closeness score (Figure 5-4) we found that most organisations had a closeness score of 40%. Mainly those organisations involved in generating and sharing information such as the statistical services (0.6) and meteorological services (0.65), and other highly central organisations such as DEM (0.68) showed comparatively high scores. Others such as The Water Authority (BWA) (0.586), Drainage (DD) (0.548) also fare well in terms of their closeness score. Notwithstanding it was telling that there were planning sector organisations and academic institutions like UWI and CIMH which received lower scores 0.333 and 0.486 respectively. This would have implications for the science policy interface that is a key component of the DRR-CCA risk governance framework in SIDS. Core institutions like Ministry of the Environment received similar scores as the social sector leaders such a Ministry of Social Care (0.523); whereas those identified as being highly involved in risk governance such as the Coastal Management agency (CZMU) did not display strong scores for collaboration (0.486). The results seemed to indicate that the collaboration potential for a joined-up governance approach was limited since it was restricted to a few organisations and showed little involvement from key sector leaders and scientific organisations.

III. HIGHLY CONNECTED THOUGH MISSING CRITICAL ACTOR LINKS

Due to assumed high social cohesion and smallness in SIDS, the network as a whole should have been quite dense with a score that is close to 1. The density measure indicated that the network was indeed very dense (0.865). This implied a very connected network with high potential for the joined-up approach. Notwithstanding it seemed that this potential could be limited by the missing links between social type actors – community based organisations, NGOs and ‘vulnerable groups’ and market actors e.g., tourism with state actors. This has implications for the co-creation of knowledge and multidisciplinary collaboration. For example while the tourism organisations were on the fringe of the network they had little to
no connections with technical government institutions such as the Town Planning, Coastal Zone, and Drainage. They also did not have connections with the scientific organisations such as the Caribbean Institute for Meteorology (CIMH) and University. Joined-up potential would be minimised by these missing links.

Joined-up potential seemed to be further challenged by the tenuous links (low centrality) to the network by key brokers such as the Ministry of Social Care and the Welfare Department that were providing an essential link for the community focused organisations. The other group of community organisations- DEOs were also weakly linked into the network through the DEM. Moreover, regional organisations such as CIMH which also showed up as being highly involved in the risk governance process, was not as highly connected with others in the network, such as the DEM which is the most connected organisation. Other regional organisations such as the University of the West Indies are involved in several risk governance processes, though they are not well connected with other organisations at the national level. The limitations to joining-up that is related to limited connections found in practice seem to affirm those found in institutions in principle mentioned in section 5.5.1.

E. DELIBERATION- CLEAR ROLES BUT UNCLEAR ISSUES, CHALLENGED COMMUNICATION AND METHODS FOR REACHING AGREEMENT, MISSING PERSPECTIVES

Perception data from the surveys on the key indicators of deliberation (section 5.3.3.2) suggested that the system in its current form was not exhibiting significant potential for a deliberative approach to DRR-CCA risk governance. There was some potential related to clarity on roles, since several organisations (70%) indicated having a clear understanding of their role and how it fits into the risk governance process. However, several other indicators suggested low potential. Moreover since it was evident from the SNA that there were gaps in the types of risk governance activities being undertaken, it would seem that the clarity expressed here could have limited impact on the potential for integration since a number of key players were not involved in several of the risk governance processes. On all other indicators the potential for deliberation was low. Particularly those related to clarity on the risk governance system, its goals, and on risk issues were low (40% agreement). In addition, it seemed that there was a particular challenge with communication since there was little agreement (20%) that communicating and methods for reaching agreement were working even though it was a ‘small context’. Perceptions related to how stakeholders were selected and participated in the process also seemed to indicate limited deliberative potential. Only 50% agreed that there was clarity on how their views were incorporated and that there was
adequate participation and equal opportunity for input. The same result applied to their perceptions around the incorporation of multiple perspectives and disciplines in the process. In fact, practice findings also suggested there they were several stakeholders not participating in the risk governance process. Furthermore in principle, findings also suggested that there was no legislation to dictate specifically how organisations should participate.

F. KEY PROCESSES - RISK MANAGEMENT POTENTIAL BUT THREATENED BY VULNERABILITY DISPARITY

Surveys indicated that all areas of the risk governance process were being addressed (Figure 5-5) by organisations; and that their work in risk governance was mostly driven by legislation. Figure 5-5 shows that there was high involvement in areas such as risk management, risk awareness (11 organisations), risk estimation (shown as risk assessment), pre-estimation processes of early warning (shown as risk identification) and monitoring. Interestingly, this was not as high as the inclusion seen in ‘response’, where almost all participants were involved. In contrast, weak areas were identified with regards to establishing procedures (scientific conventions) (which is part of the pre-estimation stage), and hazard analysis. More critically, vulnerability assessment had limited inclusion particularly from key sectors (social care, welfare, community groups, commerce) that according to the EARG (Figure 5-1) would have a role in reducing other socio economic drivers. They were not engaging in vulnerability assessment and neither were they engaging in risk management. In general the area of vulnerability assessment had little uptake, though it should have been an activity that spanned most sector activities for risk governance. It also seemed that there may have been less vulnerability assessment in practice since survey responses indicated that some organisation’s activities which reported undertaking vulnerability assessment were not specific to Barbados or that it was oriented towards preparedness- for example managing the list of vulnerable persons for the purposes of evacuation. This gap would have particular deleterious limitations to the EARG approach.
5.6. DISCUSSION

5.6.1. DRR-CCA RISK GOVERNANCE IN DEVELOPMENT

Findings related to the limited potential for a development approach that engages development institutions (policies and laws) in risk governance for DRR-CCA in Barbados reflects global challenges. Addressing risk through policies, norms, standards and regulations for DRR remains limited across the globe (UNISDR, 2015a). Notwithstanding the Barbados case showed that policies seemed broad enough to address both CCA and DRR risk governance, where the built and environmental planning sectors provided the most noticeable potential in principle as well as in practice for risk governance integration in development. This is in line with global trends, where, integration of CCA planning into other types of plans as opposed to stand-alone policy is becoming more common with greater traction in environmental and planning agencies (Aylett, 2015).

From a DRR perspective, that the environmental and planning sectors emerged as key players may suggest that there may still be a focus on addressing specific and existing risks, such as constructing flood defences, strengthening or improving infrastructure (Lavell and Maskrey, 2014) as opposed to addressing drivers of risk (UNISDR, 2015a). It seemed that DRM legislative mechanisms were concentrating on protecting development against exogenous threats rather than reducing drivers (Kelman, 2013). This could also suggest why disparities in principle, in legislation as well as in practice networks, for socio-economic sectors such as culture and poverty alleviation, tourism and fisheries emerged to be on the periphery. These findings echo the little success globally in mainstreaming DRR priorities and ensuring that other ministries or departments besides disaster management adopt policies, norms, standards and regulations to manage and reduce risk (UNISDR, 2015a; Manyena et al., 2013). Similarly for CCA globally, it seems that socio-economic sectors such as utility sectors, and the agencies responsible for economic development, and health also contribute little to adaptation planning (Aylett, 2015).
5.6.2. POLYCENTRICITY AND MULTI-LAYEREDNESS

The Barbados case suggested a limited polycentric arrangement as they were few organisations executing authority for governing risk. The prominence of state actors such as CZMU (coastal) and Drainage (water) involved in the risk governance processes as well as lead state actors for disaster management (in principle) and network wise was a central feature that was combined with highly involved regional scientific organisations such as the Caribbean Institute for Meteorology and Hydrology. In other small island contexts for CCA including for Barbados where polycentricity has been discussed (Chen and Ganapin, 2016), it has addressed management of environmental resources such as large marine systems that are transnational resources, and in these contexts though favoured it is still a conceptual approach that could link local community activities with that of national and regional processes.

There are a number of inclusion factors that could help polycentricity to work, this can involve engaging active NGOs and a number of non-state actors including community focused local and international entities. Examples can be found of this in Indonesia for DRR (Djalante et al., 2013). The Barbados context seemed to suggest that depending on the focus of the risk governance intervention in the sector process being managed- drainage systems etc., that there would be different kinds of polycentricity that might be expected. For example for the water sector, most entities would rather be state centred as functioning NGOs are limited as well as other public formulated non-state bodies. In addition since there are many different governance structures in SIDS e.g. Hereditary chiefs, mixed NGO and government leadership this requires balanced approaches for addressing the varying scales of connection and interaction for governance (Kelman, 2016). It seems that it could be expected that there would be variation of polycentricity seen across the SIDS. Furthermore, the presence of intraregional organisations such as the CIMH may have similarities to other SIDS such as those in the Pacific but in other SIDS regions these kinds of intra-regional organisations are not present that could help with a pooled governance approach (Kelman, 2016).

In addition, it seemed that the centralised governance system that did not facilitate a community level/ or local government decision point was affecting the kind of polycentricity that may be typical (Ostrom, 2010a). Besides this, since the research did not engage with all potential actors in systems this may have limited the kinds of polycentricity expected. Wider consideration of all actors in the system could be the scope for future study. Notwithstanding, legislation seemed to confirm that the decision-making was vested with state/government
and national level organisations. The governance structure could be positive since it avoids inconsistency of policies at regional vs. local level as in other contexts e.g. Indonesia (Djalante et al., 2013), Nicaragua (Rivera, 2014), Australia (Howes et al., 2015), USA, and the EU. For example in these other contexts, building regulations at local level can be counteractive to those at national level.

Though there seemed to be some potential for multi-layeredness in principle, since in practice, there was limited community level participation in risk governance (DEOs and constituency councils); there was a clear challenge here. This reflects an on-going challenge with the community structure in Barbados which has been found by others to be limiting work in risk reduction (Pelling, 2011). The situation seems not to have improved in the intervening years as there is a lack of community groups, lack of community feeling and low involvement in community led disaster preparedness (Pelling, 2011). In addition the missing links between social type actors – community based organisations, NGOs and ‘vulnerable groups’ and market actors (tourism for example) with state actors suggested particular deficiencies of polycentricity (Ostrom, 2010a).

While there was a specialised committee to address climate change, we did not see individual units or authorities for climate change or full time officials to implement planning for climate change alone as what has been a global trend (Kern and Alber, 2008; Bassett and Shandas, 2010; Bulkeley, 2010) until recently, as austerity measures have curbed this approach. Not having adequate resources and institutions to address climate change may suggest institutional legitimacy issues and a nascent structure for CCA planning (Wejs, 2014)).

5.6.3. JOINED-UP GOVERNANCE POTENTIAL

The joined-up governance approach potential is related to multi-level governance and planning. It seemed to hold the greatest potential particularly with respect to brokering and given the denseness of the Barbados network. Particularly, the brokering role of DEM and the Ministry of Social Care suggested that they could provide a critical role in the adaptive approach since brokers strengthen social capital and the capacity for effective governance of multilevel organizations involved in the management of the systems-(Ostrom, 2008)

Notwithstanding, these organisations did not correspond with typical discussions of brokers around adaptation which is usually environmentally focused. In contrast, though the Ministry of the Environment in principle seemed to have a brokering role, in practice it did not.

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Neither of these brokers was highly involved in the risk governance process in practice. For example the Ministry of Social Care and the Welfare Department that were providing an essential link for the community focused organisations, had little involvement in risk governance processes. The DEM was also providing an essential link to a group of community organisations - DEOs that were also weakly linked into the network but had limited involvement in the risk governance processes.

The network closeness scores suggested that the SIDS network was comparatively close which also seemed to suggest some potential for the joined-up approach. Smallness has been associated with heightened social cohesion and social capital that may establish and strengthen networks in small settings relative to other country contexts (Lee and Smith, 2010; Connell, 2013) and could enhance related DRR-CCA features such as collaboration. From an individual organisation perspective however as expected, information sharing organisations were well connected as well as other highly central organisations such as the emergency management—it wasn’t necessarily spread throughout the network.

Limited closeness displayed by the planning sector and other organisations such as environmental organisations like CZMU; and academic institutions like UWI and CIMH which were otherwise highly involved in the risk governance process network, seem to suggest a weak science policy interface as also seen in other contexts (Ismail-Zadeh and Takeuchi, 2007; Innocenti and Albrito, 2011). In other coastal contexts such as Ireland (Falaleeva et al., 2011) the science policy interface has received heightened attention but this has been limited on SIDS. This could be creating uncertainty of available scientific knowledge which prevents decision-making (Wilby and Dessai, 2010). In particular, intra-regional level scientific organisations though involved in several risk governance processes, are not well connected with other organisations at the national level. There may be some implications for how scientific organisations could function in small island contexts to improve the DRR-CCA. The DRR-CCA potential may suggest a role for boundary organisations, which for now are missing from the Barbados/ SIDS landscape. Interestingly given their positions in the network, it was the DEM and MOS that could function as boundary organisations (such as the UKCIP in the UK) however there are not set up for this and neither were there other organisations in the networks that were functioning to fill the gaps between the production of trustworthy scientific/technical assessments or relevant and valid science-policy assessments at local scales to support decisions concerning sustainability (Cash et al. 2003, Folke et al., 2005; Corfee-Morlot et al., 2011).
The highly connected, very dense and multi-level network, suggests the modality for generating and sharing knowledge and developing social capital as well as legal, political, and financial support to ecosystem-type management initiatives (Ostrom, 2010b) and by extension the systems approach. However, the potential seen in Barbados is cautious since as in other cases such as the Pacific (Gero et al., 2010) and in Central America (Rivera et al., 2015) looking at DRR-CCA, the independent and different ministries for DRR and CCA would be a hindrance. Since it is at the level of the ministry that a supporting framework for a DRR-CCA governance process is provided- the budgets, policies and administrative support, it would seem that issues connected to unjoined-up resourcing and individual visioning could inhibit the best intensions of an adaptive approach (Baird et al., 2016).

5.6.4. KEY PROCESSES AND THE SYSTEMIC APPROACH

Our findings concerning high engagement in risk management, but low engagement with vulnerability assessments that should inform the approach, could suggest that risk management approaches may not be effective. This is because limited inclusion of vulnerability assessment particularly from key sectors (social care, welfare, community groups, commerce) according to the EARG would suggest issues with reducing other socio economic drivers of risk (UNISDR, 2015a). Furthermore a systems approach that should characterise the vulnerability assessment was not evident. Literature suggests that in the case of SIDS, limited capacity in understanding interactions within and between ecological, social and or economic subsystems (Lal, 2011) could be limiting the uptake of the systems approach. In addition as systemic approaches requires the combination of different knowledge systems (Ostrom, 2010a) as will be discussed in the subsequent section this area was also challenged.

5.6.5. INCLUSIVENESS

The SIDS network was highly dense however inclusiveness centred on a core group of participants, with underrepresentation or disparities in the social and economic sectors. The under-participation of tourism suggests severe implications, since tourism is closely connected with an ever increasing build-up of capital and assets in risky areas (UNISDR, 2015). This is not surprising as institutions to support their involvement were not found in principle (UNISDR, 2015a). Forino et al., (2015) emphasise the importance of engagement with social systems conceptually for DRR-CCA and in this case in the context of risk governance it has emerged as a specific gap in the case of Barbados. The self-exclusion of
economic sectors may point to limited understanding of their role for DRR and CCA (UNISDR, 2015a). The high duplication of actors amongst the DRR and CCA structures that was found, has also been recognised in other SIDS contexts (UNISDR and UNDP, 2012) and would be a significant drain on already limited resources in the SIDS context.

5.6.6. DELIBERATION

That there was clarity on roles of organisations in the risk governance process suggested some potential for moving ahead with risk governance (Renn, 2008). Nevertheless, this would be challenged by recognised gaps in terms of missing social and economic inputs to the process as discussed in earlier sections. Significant weaknesses related to lack of clarity on how views are incorporated and poor communication methods were obvious constraints (Renn, 2008). It was not clear if this was a SIDS smallness issue. In other contexts such as Scandinavian territories where there is high adaptive capacity, small municipalities are not disadvantaged as they apply explorative approaches to CCA and this seems to help minimise issues of their smallness (Wejs, 2014).

5.7. CONCLUSION

We set out to examine how existing DRR and CCA institutional structures and processes in Barbados exhibit the potential for integrated risk governance based on nine indicators of a framework developed for SIDS. This was in terms of what was documented in principle and what was practiced with respect to the communication networks that actors identified that they were engaged with for risk governance. There were particular differences noted between what was documented and practiced. For example there seemed to be a multi-level approach to DRR and CCA to some degree which was not very strong in practice such that the community level was not functional. In addition, a highly multi-sectoral approach was evident which in principle was very duplicative for DRR and CCA. In principle also, there was great polycentricity, and a number of independent laws for engaging with risk governance however, in practice this was only a few technical organisations. In general, there was modest potential displayed for DRR-CCA risk governance in principle and in practice networks in the case of Barbados. These were related to 1) different kinds of polycentricity displayed in the network for example because of the absence of local governance and the role of intra-regional organisations, 2) a highly dense network that lent to better information sharing as well as, 3) key brokers that could serve as important points for sharing and flexibility. It seemed in particular that the disaster management network based on the number of connections
associated with the lead disaster management entity offered a high potential for DRR-CCA though itself not strongly involved in the technical aspects of the risk governance process. Whilst these integration features were not necessarily related to SIDS smallness with the exception of the high density of the network displayed, it seemed that smallness did not necessarily lend to more potential for DRR-CCA risk governance as issues with low inclusion and collaboration persisted.

A number of issues have been highlighted related to the potential for DRR-CCA risk governance that suggest that SIDS could be facing similar challenges found in the literature with respect to limited integration of risk governance for DRR and CCA in development policy. Similarities include little existing integration in legislation and policy, limited involvement of social and economic sectors in risk governance and under-developed community involvement. Other areas such as issues with low engagement with vulnerability assessment and the absence of systemic approaches were new areas that emerged as challenges to DRR-CCA. Other issues related to limited science policy engagement, weak arrangements for deliberation- that included weak methods for communication and incorporation of views seem to have potential to hinder risk governance. The latter has not emerged as an issue until now in integrating DRR-CCA. There also did not seem to be any smallness specific challenges.

The conditions necessary for DRR-CCA risk governance to emerge in practice, the associated network structures and relational patterns still require further investigation. In particular, as in resource rich contexts it has been found that, ‘the context of climate change adaptation may require a different social network structure and processes than other contexts for adaptive co-management to occur’ Baird et al., (2016). Particularly super wicked problems such as funding constraints, competing initiatives, and the lack of common views among participants can pose more of a problem than ensuring for example that adaptive elements (Baird et al., 2016) such as deliberation, polycentricity and flexible elements that we have discussed. Further work is needed to deeply examine the challenges in SIDS and identify solutions that could allow them to take advantage of their potential for DRR-CCA risk governance in view of their varying governance contexts. Further analysis of shared policies and values that could help with joining up is needed.
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CHAPTER 6. PAPER 3: CHALLENGES TO SUCCESSFUL DISASTER RISK REDUCTION (DRR) AND CLIMATE CHANGE ADAPTATION (CCA) INTEGRATION: ARE SMALL ISLAND DEVELOPING STATES ANY DIFFERENT? EVIDENCE FROM BARBADOS

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6.1. ABSTRACT

Small Island Developing States (SIDS) are expected to suffer inordinately from climate change and disasters. In response, integrated approaches to Disaster Risk Reduction and Climate Change Adaptation (DRR-CCA) have been offered as the most rational way forward. A risk governance approach provides a means for understanding DRR-CCA challenges in practice by giving consideration to the economic, social or institutional contexts of the risk decision making process. This paper builds on case study findings on the potential for DRR-CCA in Barbados. It investigates: What are the DRR-CCA risk governance challenges in Barbados as a SIDS? Why do the challenges occur and how does islandness influence them? Findings from interviews, documents and surveys from 21 organisations operating at different levels suggest familiar challenges such as fragmentation and poor communication. New challenges were identified related to islandness features that seemed to be curtailing capacity for DRR-CCA. These included the absence of systems approaches that account for socio-economic and environmental interactions.

Keywords:

Disaster risk reduction, climate change adaptation, integration, Small Island Developing States, Barbados, risk governance, island studies
Island communities bear characteristics of both vulnerability (Nurse et al., 2014) and resilience to climate related hazards (Campbell, 2006; Kelman and Khan, 2013) Specific development characteristics of Small Island Developing States (SIDS) play a particular role in contributing to their vulnerability. SIDS are located across three geographic ocean regions, a) the Caribbean, b) the Atlantic, Indian Ocean, Mediterranean and South China Sea (AIMS) and c) the Pacific (Pelling and Uitto, 2001). They are characterised by small economies, small populations and limited capabilities which can minimise the resources available to reduce potential losses from climate related threats (Nurse et al., 2014). Highly specialised development models and highly connected ecosystems and livelihoods also heighten SIDS vulnerability (Nurse et al., 2014). SIDS have some of the highest concentrations of risk, and disasters can result in disproportionate economic impacts (Briguglio, 1995; UNISDR, 2015a). Furthermore, rapid urbanization, eroded traditional approaches (Nurse et al., 2014), colonialism, development and globalisation in SIDS (Campbell, 2009) and climate change may be compromising indigenous capabilities for long-term adaptation (Kelman, 2017). Disasters and climate change present an existential threat to SIDS (UNISDR, 2015a).

This paper focuses on two promising approaches to address the SIDS crisis- Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA). Both approaches seek to reduce vulnerability, but despite apparent benefits of integration, such as the improved use of scarce resources, holistic planning and efficiency, separation still persists (Mercer, 2010; Howes et al., 2015). Problems stemming from separate international frameworks (Kelman and Gaillard, 2010); parallel funding streams (Gero et al., 2011; Howes et al., 2015); and differences in origin, terminology, scales, knowledge, and norms (Birkmann and von Teichman, 2010) could eclipse the potential for integrating DRR and CCA (DRR-CCA) in SIDS. Furthermore, SIDS’ development practitioners and political leaders give limited priority to addressing DRR and CCA (UNISDR and UNDP, 2012).

There are examples of institutional adjustments for integrating DRR-CCA in practice (UNISDR and UNDP, 2012), e.g. in the Solomon Islands a joint framework for resilient development that integrates CCA and DRR has been developed (Nalau et al., 2016); however these examples are limited (Dhar Chakrabarti, 2010; UNISDR and UNDP, 2012). Research from both mainland and island contexts suggest that there are practical issues with governance.
For example, challenges with human and institutional capacity, communication and coordination. Capacity constraints include increased work-loads and resource constraints (Howes et al., 2015); and difficulties with sustaining coordination infrastructures (especially when externally funded) (Nalau et al., 2016). Institutional and coordination challenges exist across multiple scales and levels; and separate and traditional DRR and CCA structures tend to emphasise mandates and silo approaches (Djalante, 2013; Rivera et al., 2015; Nalau et al., 2016). Unadjusted development sector legislation to address DRR and CCA has also been problematic (Rivera et al., 2015). Communication challenges identified include the absence of information on underlying socioeconomic and environmental risk factors (Dhar Chakrabarti, 2010). There are also issues with the user-friendliness of risk information, fragmented DRR systems; as well as poor protocols and standards for information acquisition and sharing (Dhar Chakrabarti, 2010; Rivera et al., 2015). There is however limited research specifically exploring the impact of islandness on integrating DRR-CCA.

This paper examines the challenges to DRR-CCA particularly in the context of how the risk decision making process is governed- risk governance. A risk governance perspective considers the networks, actors, and institutions that are involved in risk decision making processes and their legal, economic, social and institutional contexts (Renn, 2008). It builds on the classical risk management processes of hazard identification, risk assessment, judgement and communication. There is already evidence particularly from European countries that country contexts may determine the uptake of risk governance approaches (Rothstein et al., 2013). This has not been extended to consider SIDS specifically. This paper builds on an emerging discussion on how island contexts impact on reducing disaster risk including from climate change (Kelman, 2017); and presents a risk governance perspective. As ‘islandness’ shapes and conditions contexts (Baldacchino, 2006) we investigate how it may contour challenges to DRR-CCA. This has implications for how lessons learnt for DRR-CCA may be applied and transferred.

Evidence on challenges to DRR-CCA in islands has focused on Pacific islands (Gero et al., 2011; UNISDR and UNDP, 2012; Nalau et al., 2016), however there is limited information from Caribbean SIDS perspectives. Therefore this paper examines the case of a Caribbean SIDS, Barbados. It asks, what are the DRR-CCA risk governance challenges in Barbados, as a SIDS? Why do governance challenges occur and how does islandness influence them? Barbados is an interesting case for this research. Though only 431 km² in size, and having a population of 277,821 (according to the 2010 census), Barbados ranks no.54 out of
188 countries on the UNDP Human Development index (UNDP, 2016). It receives a high rating for governance (World Bank, 2012) and is governed by a central government structure. Tourism contributes almost 40% to Barbados' GDP (WTTC (World Travel and Tourism Institute), 2017). As such it remains the predominant generator of foreign exchange in the country. Barbados has been described as a climate dependent economy (Mycoo and Chadwick, 2012). It has also been identified amongst SIDS as having the highest urban produced capital and gross fixed capital formation at risk to pond flooding (UNISDR, 2013). This type of flooding derives from direct runoff of rainfall water (overland flow) (Abhas et al., 2012) and can lead to a number of secondary hazards such as vector and water borne diseases (UNISDR, 2013). Due to the importance of flooding in Barbados, this research pays particular attention to the risk governance process from this perspective.

This paper builds on previous work on initial challenges to DRR-CCA in Barbados (Greenidge et al., forthcoming). It undertakes a deeper examination of the challenges identified, why they occur and how islandness affects them. This is done through a thematic analysis of data collected from in-depth interviews with DRR and CCA stakeholders at various levels of decision making. The paper is arranged into three sections. The first section presents the framework used to identify the challenges in the study along with previous initial findings. Thereafter, the DRR-CCA challenges found are discussed in the context of islandness. Finally, we conclude with implications for DRR-CCA approaches and contributions to island studies.

### 6.3. CONCEPTUAL APPROACH

#### 6.3.1. FRAMEWORK FOR IDENTIFYING CHALLENGES

We employed a risk governance framework that was designed for SIDS to identify challenges to DRR-CCA. Specifically, the Enhanced Adaptive Risk Governance (EARG) framework (Greenidge et al., n.d.). The EARG is an enhancement of the Adaptive Risk Governance Framework (Renn and Klinke, 2013). It builds on key DRR-CCA principles such as joined-up and networked approaches (e.g. sector cooperation, shared policies, purposes, values and visions) (Howes et al., 2015). Other principles of polycentricity (non-state centred authority and non-hierarchical cooperation) (Klinke and Renn, 2012; Ostrom, 2014); and multi-layeredness (e.g. entities from different geographic scales or task specific jurisdictions (Hooghe and Marks, 2003; Djalante et al., 2013) are included. Further it emphasises a systemic approach that considers socio-economic and environmental systems interactions to identifying and managing risks in SIDS that infuses four other main approaches (Figure 6-1).
FIGURE 6-1: ENHANCED ADAPTIVE RISK GOVERNANCE FRAMEWORK FOR SIDS (AUTHOR’S FIGURE)
It was anticipated that there could be potential challenges related to any of the principles and elements of the EARG. With respect to element 1 (Figure 6-1), we looked to see if DRR and CCA related policies and norms addressed risk governance as part of a development objective; whether the approaches were multi-layered and if long-term and short term climate extremes were targets. Concerning element 2 we looked for the extent to which key steps such as, pre-estimation and interdisciplinary estimation (risk assessment and vulnerability assessment) inter alia were functioning. Finally, to identify how the risk governance processes were operating, we looked for gaps at elements 3, 4 and 5 e.g. concerning communication and inclusion, as well as joining up and the institutional support and resources for risk governance.

The impact of islandness on the challenges was identified based on the literature on smallness introduced at section 1 on resource availability, and peculiar vulnerabilities to risk, including insularity and remoteness (Connell, 2013). In addition we considered how islands’ extensive coastal zone to land ratios and pressures from development (McCall, 1994; Nunn, 2004) could be operating. As well as the role of social and cultural island ideologies (McCall, 1994); and knowledge deficiencies (Kelman, 2017) in framing challenges.

6.3.2. INITIAL DRR-CCA CHALLENGES FOR BARBADOS

The data for the research combines data from a previous study on the potential for DRR-CCA in Barbados (Greenidge et al., 2017) that also identified challenges to DRR-CCA using social network analysis (SNA) (Borgatti et al., 2013) of 15 organisations, and document analysis (Bowen, 2009) of 11 documents. This study uses interviews for deeper analysis of the challenges that were identified and why they occur.

The SNA in the former study used an online questionnaire to ask about risk governance activities that organisations were involved with; which organisations they shared with; the type of relationship (information sharing vs. collaboration); and the strength of the sharing relationship. Challenges identified in the first study related to limited integration of DRR and CCA risk governance in development policy (element 1). Moreover there was low engagement with vulnerability assessment (VA), though VA is critical to reducing risk drivers (element 2). There were also issues with involvement and communication (element 3).
Specifically, socio-economic participants such as tourism, NGOs, social care, and commerce were disengaged in the risk governance process; and there were missing sharing connections between academic/technical; and community/social organisations. At the core (element 4), a socio-ecological systems approach to reducing risk was also missing. Finally there were gaps in joining up (element 5), due to parallel and poorly connected policies and institutional structures, for DRR and CCA.
6.4. METHODOLOGY

6.4.1. DATA GATHERING

Data was gathered from 15 semi-structured interviews with representatives of 8 DRR and CCA core organisations in Barbados. Organisations were selected based on a purposeful sampling approach (Patton, 2015), hence the number of interviews reflects those organisations and participants that were the essential sources of information on risk governance that was necessary for the study. Participants were selected from different levels of decision making that concerned governing flooding: very-high-level (Minister or Permanent Secretary); high-level (Heads of Departments) and technocrats (Information systems manager, Programme Officer, Lecturer). They were also from different scales of operation (national and regional). During a six month data collection period in Barbados, the researcher worked as part of the Department of Emergency Management (DEM), which is the organisation with the responsibility for disaster management. Invitations to participate in the study were dispatched under the auspices of this agency. Besides the DEM, participants included the Ministry of the Environment (agency responsible for climate change), the Town and Country Planning Office, the Drainage Division (entity responsible for flood management), the University of the West Indies, and the Caribbean Institute for Meteorology and Hydrology. The risk governance conceptual framework presented in Section 2 provided the basis for the questions used in tailored interview guides for each type of participant. These guide covered similar topics to the online questionnaire in the first study (at section 2.2) (Greenidge et al., forthcoming) and therefore asked about, roles in the risk governance process for addressing climate related hazards; information used and sharing networks; tools; communication; development connections; pathways to integration and improvement. Full ethical procedures were followed.

6.4.2. DATA ANALYSIS

Thematic analysis (Braun and Clarke, 2006) was applied to the transcripts derived from the interviews. Transcripts were first coded using themes generated from the literature and the conceptual framework and then coded using an inductive approach. Coding was done across all transcripts to look for patterns and variations. After refining with reference to experience, literature on DRR-CCA challenges, and previous findings (Greenidge et al., forthcoming), 6 themes were determined that were later condensed into two broad themes. These were:
1) ‘systems and development’ from the sub-themes i) missing connections ii) DRR in transition; and

2) ‘more disconnections’ from the four remaining sub-themes- iii) cohesion issues (including fragmentation, mandates, risk information sharing, planning and impediments), iv) making sense of risk, which related to capacity, coordination and communication, v) risk a side issue; and vi) smallness negatives.

Together with the results from study 1, data analysed represented 35 organisations (Table 6-1).

Table 6-1: List of Study Participants

<table>
<thead>
<tr>
<th>Data Source</th>
<th>Organisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interviews</td>
<td>1) Town and Country Development Planning Office (TCP) 2) Ministry of the Environment (MOE), 3) Ministry of Home Affairs 4) Coastal Zone Management Unit (CZMU) 5) Department of Emergency Management (DEM) 6) Drainage Division (DR)</td>
</tr>
<tr>
<td>(National)</td>
<td>7) Caribbean Institute for Meteorology And Hydrology 8) University of the West Indies: Centre for Resource Management and Environmental Studies; Department of Computer Science, Mathematics and Physics</td>
</tr>
<tr>
<td>Electronic Questionnaires</td>
<td>23) Barbados Chamber of Commerce and Industry 24) General Insurance Association of Barbados (GIAB), 25) Barbados Red Cross (BRC) 26) Community Development Department (CDD) 27) Department of</td>
</tr>
</tbody>
</table>
6.5. RESULTS

A number of challenges identified through the interviews validated the previous findings from the SNA and document analysis (Greenidge et al., forthcoming). Challenges related to a limited development and systemic approach; separate DRR and CCA institutions and structures; and gaps in sector involvement. Challenges with communication and missing community engagement were validated. Other challenges such as limited engagement with VA, which was identified in study 1, were not picked up in the interviews but clearly remain a challenge. Overall, the interviews highlighted challenges that concerned ‘how’ the risk governance process was operating (Greenidge et al., forthcoming). We present findings on challenges identified from the previous study as well as additional challenges highlighted by the interviews and later discuss why they occur in the context of islandness.

6.5.1. LIMITED SYSTEMS AND DEVELOPMENT APPROACHES TO RISK GOVERNANCE

Interviews suggested that the systemic approach was being considered by environmental sector stakeholders such as the Coastal Zone and Drainage. As one respondent notes for drivers affecting impacts on coral reefs,

*A lot of it isn’t under our control per se . . . For example let us look at storm water runoff and it’s coming from the dense gully networks and the gutters and the storm water drains that network all across this island- from the centre right to the perimeter within the coastline, [CZMU] doesn’t manage that. It then falls under drainage and so forth and then some level of responsibility falls to the public itself as it relates to dumping in gullies and excessive removal of vegetation which can contribute towards soil erosion, inappropriate farming practices, be it the applications of pesticides or the contouring of their fields on slopes.* (High-level decision maker)
The challenge was that other stakeholders and decision makers were not making systems connections. There were also minimal development approaches to risk governance. As found previously (Greenidge et al., forthcoming), there was limited evidence that Risk governance was undertaken because it was a clear purpose of organisations’ development mandates. At the individual organisation level, with the exception of ‘Drainage’, organisations were not necessarily carrying out their work as part of a process to reduce risk or adapt to climate change. One respondent said,

*Well we don’t monitor with that (climate change) in mind. So we will monitor sea temperature because we know that coral reefs can get stressed at high temperatures – coral bleaching etc. so you monitor sea temperature. We monitor coastal erosion because we know that beach loss has an impact on the usability of the beach, tourism, and those kinds of things.* (Coastal technocrat)

This challenge seemed to reflect that DRR and CCA had not been translated into mandates and structures, though indirectly, organisations were undertaking some aspects of risk governance. As stated by the same respondent,

*So they’re not measured because they are a climate related impact. They are measured because of another management aspect that the Coastal Zone is responsible for that is part of our mandate.* (Coastal technocrat)

In fact, there were no explicit legal mandates across institutions to apply risk based approaches. Furthermore, from a CCA perspective, findings from the interviews revealed there was an expectation for a risk governance structure to roll out at the individual organisation level. As mentioned by one respondent,

*Well as the coordinating office . . . we would expect the Ministry of Agriculture to identify the priorities for them [selves] because that is their mandate. If you are talking about climate change and water, we would expect that the Barbados Water Authority-still the Ministry of Agriculture [would identify their own priorities].* (High-level decision maker)

This mismatch between mandate and expectations would seem to be a particular challenge to practical examples of CCA risk governance that was part of day-to-day practice. This idea of how DRR and CCA concepts have escaped connections with mandates seemed to be
connected in part with other issues. One such area relates to an underdeveloped DRR perspective.

6.5.2. UNDERDEVELOPED DRR PERSPECTIVE—LIMITED ADOPTION OF RISK BASED APPROACH

From a DRR perspective, evidence from high-level interviews suggested that an underdeveloped perspective of DRR beyond preparedness and response persisted. This is a challenge to DRR-CCA integration at a fundamental level since both focus on reducing vulnerability and drivers of risk, such as poor development or poverty reduction. Interviews and document evidence suggested that adjustments from response to risk reduction were hardly made in practice and legislative adjustments were incomplete or non-existent. There was no CCA policy and the DRR policy did not address underlying risk drivers. Moreover the role of development sectors in DRR was not addressed in the current legislation. As one interviewee said:

*The Act [Emergency Management Act] has not been given the authority that is required, the articulation is not there . . . for other players at the national level, regional level, international level. So that without that clearly spelt out mandate and [while] the component parts in this coordinating mechanism are not clearly identified, you are fighting an uphill battle.* (High-level decision maker)

In fact, beyond the legislation there had not been much adjustment to the disaster management organisation (DEM) structure from the predecessor response agency—CERO (Central Emergency Response Organisation) that it transitioned from in 2005. The current DRR system was not designed to address development drivers of risk rather it existed to respond to disasters. Interviews also provided further evidence that there were no institutional adjustments for DRR. This was creating capacity shortfalls and challenges to coordination. An interviewee noted that,

*The DEM’s capacity to lead is hampered by providing some kind of competency for the coordination; and therefore although you know that it needs to be done . . . there is not a sustained effort at carrying the thing to the last mile. Just concentrate on the warning, the response, and a little bit of the recovery, because at some point the recovery is*
handed over to the line agencies and we get ready for the next impact. (High-level decision maker).

Indeed the modality for carrying out the necessary functions requisite with a DRR paradigm shift was not fully articulated and similarly not resourced. This in turn was limiting the kinds of approaches that would be necessary for DRR, far less for CCA, as illustrated here:

Right now we only have one officer who tracks the discipline [climate change], but the leadership plan [climate smart DRR national plan] is not ours. All of these things have separate names depending on what the international community decides on . . . and then these things are given to some departments and ministries without a clear understanding of how they will exist in the overall programme of government. (High-level decision maker)

Exceptions to the preparedness and response approach to DRR were found in environmental organisations such as CZMU and Drainage which recognised the need to reduce drivers of risk. However amongst very-high-level decision makers, information on response and improving readiness (such as on shelters, and evacuation routes) was prioritised as the modality for reducing risk. Furthermore social sector representatives highlighted the disconnection with DRR and development where for example meetings of the Vulnerable Persons Committee, ‘focused solely on preparing for the Hurricane Season’ (Social sector Technocrat).

6.5.3. MORE DISCONNECTIONS- FRAGMENTED STRUCTURES AND CHALLENGED INFORMATION SHARING ARRANGEMENTS- COHESION, CAPACITY, MANDATES AND FORUMS

High-level interviews confirmed the challenge previously identified regarding fragmented DRR and CCA structures (Greenidge et al., 2017). As explained by one respondent:

One of the difficulties we have had as the Ministry of Home Affairs has been where does our climate change agenda begin and end- in terms of who has responsibility for climate change adaptation. That remit actually resides with the Ministry of the Environment . . . .

If what we are seeing and hearing in terms of climate change impact . . . simply put is
disaster and eminent disaster, we still need to put whatever framework in place to ensure that we can minimize whatever risks they are . . . . There is [a] need for greater integration. (Very-high-level decision maker)

The previous quote shows recognition of similar interventions for DRR and CCA that cross both environment and disaster management ministries. In further recognition of overlaps in the ministries, respondents referenced a Boardwalk on the south coast that was designed to prevent beach erosion but simultaneously it protected coastal properties and served as a social amenity and tourist attraction. According to one respondent, 'this is an example of what Government did- what the Ministry of the Environment did, but the DEM could have done the same thing' (Very-high-level decision Maker). Some respondents felt therefore that a sturdier collaboration framework was needed for DRR and CCA that would go beyond sitting on administrative committees. Furthermore it was suggested that,

We would want a greater sense of understanding between our [DRR] discipline and their [CCA] discipline and I don’t know how it is configured now, how it will happen. We would either have to be under environment or environment [ministry] under us so that you can see a way of ensuring that it is done. [High-level decision Maker]

Although several communication and joining-up challenges were identified, there seemed to be some political will to begin a conversation on integration. Notwithstanding it was recognised that climate change mitigation issues such as ‘green energy’ would need to be separate. Interviews also confirmed similar communication gaps that were found in the SNA with sharing information between academia/technical organisations; and community/ socio-economic partners (Greenidge et al., 2017). Figure 6-2 summarises the interview findings concerning why the information base was poor. Some issues include capacity gaps, bureaucracy and non-user-friendly or inaccessible (particularly scientific) information.
We found that some of the information challenges such as co-production of knowledge and translation of climate change data into usable formats for decision making were already identified for attention by national and regional organisations; and that projects were therefore put in place for this purpose. For example, CDEMA and CIMH (regional organisations) were implementing the Caribbean Risk Information System and Climate Services projects respectively. At the national level there was a Coastal Risk Information Programme that was developing a National Coastal Risk Information Platform (NCRIP). Not only were national entities critical for strengthening information shortfalls, but regional agencies seemed to have a role in addressing national capacity issues. As one regional respondent indicated this was because of smallness issues,

*Smaller centres . . . don’t have the resources to actually provide [global models] but at regional level for instance, we downscale that information . . . And the national climate data or climate information products that target specific sectors would be hosted nationally . . . . That is now being rolled out progressively so the capacity at the national level is one of our primary concerns as we speak.* (Regional Technocrat)
Despite these projects, capacity issues remained with supporting necessary sustainable structures for the on-going production, sharing and management of information. Several respondents indicated that the work required was outside of their time, funding and planning horizons (MOE, DEM, DR, and UWI). Some felt that it was beyond their job roles and mandates (MOE, UWI, MOHA, and MOH). This highlights the need for mandates to be addressed in the future so that capacities are not lost. Two respondents said,

_We suspect that a lot of the data is available, but as I said the agencies having it are not consistently mainstreamed to provide it; and even if it is provided there is no infrastructure within the Department to collate it to have it available and to refer to it._

(High-level-Decision Maker)

_As much as I would like to conceptualize a climate change research topic and use it for building a climate change intervention . . . we don't have the latitude to do this . . . . We are not assigned to be dedicated solely to this one topic. Demands on time pull you in different directions._

(Technocrat)

Sustainable structures for information sharing were further stymied by the absence of policies and protocols for sharing. Some respondents highlighted that there were informal sharing arrangements between individuals which were not officially incorporated in job descriptions. Hence, when individuals left the organisation, there were set-backs. Unclear roles and expectations were also evident amongst research organisations. There was an assumption that assessments for hazards and risks were being done at the national level by someone else, since it was not their role to do specific country assessment or to do further down scaling of their work. A trickle-down effect was that, given uncertainties related to the unavailability of statistical analysis of trends in the national context and limited rainfall data for inputs to climate models at the regional level, policy adjustments were negligible.

In addition to capacity constraints and uncertainties concerning roles, limited cohesion amongst risk governance knowledge providers was seen to be a particular challenge. Some respondents suggested that the absence of a central ministry or forum to promote cohesion and connectivity, minimise duplication, and facilitate technical cohesion, co-production of knowledge and coordination as well as to enhance the resource base and the ability for
decisive action (TCP) was a particular gap. Notwithstanding, there was uncertainty concerning how information would be accessed in view of current governance structures (TCP), though there were sentiments that in times of crisis this worked out.

6.5.4. INFORMATION AVAILABILITY MISMATCHES, ‘POLITICAL WILL’ AND RISK SIDE ISSUES

It seemed that there were challenges with respect to availability and transparency of information on risk. Only 40% of survey respondents agreed (30% disagreed, 30% remained neutral) that there was a clear understanding of risks or potential losses and that there was competency (Greenidge et al., forthcoming). With the exception of limited availability of climate change information, some high-level decision makers seemed however to view the information that they had on risk as satisfactory, though in reality it was limited. Very-high-level decision makers made insufficient demands for hazard and risk information. Technocrats however believed that information was available, but that there was a need for openness and transparency on communication issues, both of which were highlighted in the study. As one interviewee put it:

As SIDS, we are faced with a host of challenges and climate change is just one, and a lot of what we fear, are the things that hold us back . . . openness of information . . . and building an informed society. We can’t be scared anymore of what people may think . . . . It is better to inform people instead of persons thinking things are fine and good when they aren’t. (Technocrat)

It was suggested that low regard for DRR and CCA compared to other issues was the cause for inaction from political decision makers. Risk was a side issue. Respondents pointed to examples of low priority based on lapsed enforcement of environmental regulations, as limited political will. Additionally, limited vivid experiences with disasters by the public were also cited. From another perspective, high-level decision makers suggested that they were amenable to making necessary adjustments to systems given reliable evidence.

Besides these differing perceptions concerning risk, potential challenge to DRR-CCA were identified because of limited data, and minimum institutional support that made it difficult to pursue heavily scientific processes. For example, in providing inputs on the flood risk, methodologies relied heavily on experience, expert opinion, field visits, and community input.
This approach seemed to be working with the present climate extremes and as mentioned by one participant, it reduced the flooding and provided ‘betterment’ by using structures and principles that were known to work in Barbados, though not a calculated or exact science per se. Furthermore smallness helped with familiarity of landscapes. As one interviewee said:

*Flooding evolves and you know that by experience . . . from the people that live in the area . . . they would tell you –this flood in 2004, 2008 . . . and we can look at those periods . . . [on] average every 5 years it floods . . . . We can reduce it [flooding] . . . there are proven structural methods that work in Barbados . . . . We don’t have to go and measure anything we know . . . . I know the sites generally and I would put them [flood observation pictures] in folders. It is that kind of thing that GIS would work for . . . the island is small, you know where it is.* (Technocrat)

The challenge with this approach for DRR-CCA is that it doesn’t have a view of the future, and planning for future challenges like those from climate change. While most organisations perceived that through development control the risk based approaches applied were adequate, the uncertainty brought by climate change, means that previous experience may not reflect what may be expected in the future particularly given projections for SIDS - a new approach may be needed.

### 6.6. DISCUSSION

A number of challenges to DRR-CCA from the Barbados context have resonated with those reported in other contexts such as Nicaragua and Australia (mainland) as well as in the Solomon Islands. For example, the challenge of fragmentation of DRR and CCA structures (Djalante, 2013; Rivera et al., 2015) was identified as a challenge to technical cohesion. There was also evidence for traditional structures such as separate ministries that undermined the potential for a joining up approach to DRR-CCA (Howes et al., 2015). Another similarity with other contexts was the issue with poor systematic scientific exchange at the community and national levels; and issues around having understandable formats (Rivera et al., 2015). Prior studies on Barbados and other Caribbean SIDS on DRR have also highlighted this issue (Evanson, 2014). This is problematic since user-friendly and accessible information is an essential feature for an integrated system (Spiekermann et al., 2015). Interestingly it did not seem that they were conflicts between knowledge from the scientific and community on risks or competing national vs. regional claims on authority for managing risks as found in
other studies (Rivera et al., 2015). This may have been linked to the central governance system in Barbados.

Our analysis of the case of Barbados offers insight to the sources of the scientific risk information used in a small island context. More often than not, such data reside in regional institutions because of scarce local skills. The challenge however is that regional organisation roles are not specified for assisting countries in risk governance systematically. This becomes particularly important where current methodologies and baselines for managing flooding based on experience and indigenous knowledge will likely become challenged by climate change (Kelman, 2017). Technical strengths of the risk governance approach were further inhibited by common challenges such as issues of coordination across different levels of governance, including amongst various public sector, private sector, and local communities (Dhar Chakrabarti, 2010; Nalau et al., 2016). The Barbados case however further highlighted that even in a small island context where there is a central governance structure; there is still the issue of coordinating national level technical exchange. Exchanges were mostly based on informal organisation relationships as in other contexts e.g. Australia (Howes et al., 2015). The challenge was that there was still a need for a mechanism to maintain 'sharing' outside of times of emergency.

Similar to other contexts (Howes et al., 2015; Nalau et al., 2016), challenges with capacity were found in Barbados. Barbados' context, however, pointed to other underlying issues of capacity such as perceptions that the DRR and CCA risk governance work was not part of their job roles or a priority. There seemed to be an underlying context that was influencing this mind-set and governance arrangement that was related to some issues of what was considered to be 'core services' (Howes et al., 2015) and the contexts from which institutions were functioning. One issue was that of how DRR was viewed. Another related to the context of a limited adoption of risk based approaches. There was no evidence of a deficient political will for DRR-CCA as suggested by others (Howes et al., 2015). Notwithstanding there was evidence that risk based approaches were not prioritised. In other contexts such as the UK, where there are entrenched governance norms and accountability structures in national policy domains, it is the context that determines the uptake of risk based approaches (Rothstein et al., 2013). Barbados has loose norms and accountability structures for risk governance-which is an issue in other countries (Rothstein et al., 2013). Updating of legislation to reflect DRR and CCA was very limited and did not extend across sectors such as
environmental policy, as seen in other contexts (Rivera et al., 2015). This meant that DRR and CCA had not been translated in mandates or roles.

A fundamental issue seemingly linked to the challenge of an inadequate risk based approach is that of limited transition from preparedness and response to a full DRR approach. The recent Global Assessment Report (UNISDR, 2015), highlights that the requisite meaning of DRR in the national structure is yet to emerge and this was the case for Barbados. In fact as highlighted in other reviews, Barbados' Emergency Management Act does not address the implications/roles for other sectors (Evanson, 2014). This greatly hinders the capacity for a risk governance process in practice, something which has not been discussed in the literature on DRR-CCA barriers. This could also be linked to some of the other challenges identified concerning the exclusion of socio-economic partners, and under-representation of community which has not emerged often in the burgeoning DRR-CCA discussion (Dhar Chakrabarti, 2010). Gaps at the community level cannot be underestimated since communities will be at the frontline of severe impacts of climate related disasters (Pulhin et al., 2010) and their participation improves the efficiency and success of initiatives to reduce risk (Mercer et al., 2007; Birkmann et al., 2010). Further gaps that were identified: such as not having understandable and accessible information on hazards, and environmental and socio-economic information as in other contexts (Dhar Chakrabarti, 2010), would be critical setbacks to addressing underlying drivers of risk. Risk is further augmented by assumptions that other sectors know how to address CCA when in fact they don't (Pidgeon et al., 2003). This did not seem to be linked with any island context.

Islandness contexts should give high priority to preserving coastal resources given their recognised value and high importance to island livelihoods (McCall, 1994). Notwithstanding, the need to preserve these resources was not linked to risk management. Other literature highlights the issue of DRR and CCA not being priorities in both mainland and island developing country contexts (UNDP et al., 2012; UNISDR and UNDP, 2012). The lack of priority given to the risk agenda was highlighted in interview findings that suggested issues with enforcement, particularly of environmental policy- though Barbados receives a high ranking for governance. As one respondent noted,

*Unfortunately enforcement is a challenge for Barbados and it is not unique to Barbados. Enforcement in small societies is always a challenge.* (Decision Maker)
There is evidence that coastal environments such as beach fronts and investments for its protection e.g. the Boardwalk were gaining importance for risk reduction and tourism development. Notwithstanding because the approach was not institutionalised it seemed that the environment was sometimes compromised by pressures for development as seen in low enforcement of environmental laws. In SIDS island contexts there is only limited space for development which may force development in unsustainable ways (Nunn, 2004). This is also associated with the highly specialised economy of Barbados that is based on tourism and the need to protect income generation from tourism (WTTC (World Travel and Tourism Institute), 2017). Pressures for the government to circumvent environmental policy in order to generate new tourism investments in the coastal zone in the face of mounting debt, continue to be the point of public dispute (Best, 2017).

Finally, our findings on the limited systemic understanding and approach highlight a potential new challenge from island contexts not receiving adequate attention in the literature on DRR-CCA. This goes beyond a recognition of different definitions for environmental systems across scales of governance (Howes et al., 2015) but a placement of human-social systems interactions at the core of the risk governance approach for success in island contexts. Consideration will also need to be given to formal and informal norms, and how they affect these system interactions (Folke, 2006).

6.7. CONCLUSION

This study found that despite being ranked highly for governance and development, Barbados like other Pacific SIDS and even some mainland countries could be faced with similar challenges concerning DRR-CCA. Some of these include fragmented structures for DRR-CCA, and issues with communication. There were still silos amongst academia/technical and other sectors even in the small island context; and an under-representation of community and key socio-economic partners. In particular, the study has highlighted two new challenges to DRR-CCA in the Barbados context which may have implications for other SIDS and wider afield. These are related to 1) a limited approach to addressing systems and their interactions and 2) the lack of a DRR transition from response based actions in institutions and mandates to a situation that would allow drivers of risk to be identified and addressed.
From an island studies perspective, our work identified that islandness exacerbates capacity shortfalls and the pressures around risk management such as environmental law and enforcement. In addition climate change will compromise methodologies that now work in the island context. We also suggest how limited consideration of island system interactions could create acute challenges for DRR-CCA risk governance and sustainability. The study has initiated a discussion on how islandness can affect DRR-CCA and highlights the need for more studies to ensure that maladaptive and untailored approaches are avoided. Future research can begin to investigate challenges at the more intricate levels of individual systems related to planning, poverty reduction and environmental conservation for DRR-CCA. Other cases are needed given the diversity amongst islands in geography, governance, culture and biodiversity. This can help bolster evidence for bottom-up integration in practice towards adjusted national and international agendas.

6.8. ACKNOWLEDGEMENTS

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CHAPTER 7. ‘CONCLUSION

We would want a greater sense of understanding between our [DRR] discipline and their [CCA] discipline ‘I don’t know how it is configured now, how it will happen’.

Interviewee in Barbados, 2015

7.1. INTRODUCTION

This thesis has been arranged according to three main parts to answer the central question- ‘What are the prospects for establishing an integrated disaster risk reduction and climate change adaptation (DRR-CCA) development decision-making framework for Barbados?’ To do this, the findings that emerged from the papers (results chapters) in relation to each research question and associated objective are reviewed and the specific contributions to knowledge are highlighted. Thereafter, I present the recommendations and options for Barbados specifically for establishing an integrated disaster risk reduction and climate change adaptation (DRR-CCA) development decision-making framework. I then conclude with a discussion on the main limitations, and some prospects for future study.

7.2. OBJECTIVE 1- TO DEVELOP A CONCEPTUAL FRAMEWORK FOR INTEGRATING DRR AND CCA RISK GOVERNANCE DECISION-MAKING PROCESSES IN SIDS

With respect to the first research objective, it was asked ‘How can a framework for integrating DRR and CCA risk governance be conceptualised for SIDS?’ In particular it asked 1) ‘What are the SIDS features that the risk governance framework should respond to? 2) What are the requirements for DRR-CCA integration for a risk governance framework? and 3) How could a risk governance framework incorporate the peculiar development characteristics with which SIDS are associated? The findings concerning each question are now summarised in turn.

7.2.1. WHAT ARE THE SIDS FEATURES THAT THE RISK GOVERNANCE FRAMEWORK SHOULD RESPOND TO?

Based on the literature review it was identified that the risk governance framework should respond to the limited resource context of SIDS which is worsened by fragile economies. In addition, the framework needed to address the socio-economic and environmental independencies in SIDS systems and intra-dependencies, as SIDS are highly dependent on these fragile systems. In response to these features the framework for risk governance in
SIDS should be innovative in its construct and implementation to address resource limitations. It should also be able to incorporate the complexities of development and social, environmental and economic constraints in SIDS. Economic stakeholders should have a crucial role to play in DRR-CCA in SIDS.

### 7.2.2. WHAT ARE THE REQUIREMENTS FOR DRR-CCA INTEGRATION FOR A RISK GOVERNANCE FRAMEWORK?

An approach that incorporates CCA into a modified DRR approach was identified as the best option for efficient resource utilisation in SIDS for DRR-CCA integration; rather than undertaking integration in parallel DRR and CCA approaches. The modifications to the DRR approach called for a framework that could 1) address incremental stresses to everyday livelihoods as well as shifting baseline conditions for CCA through learning and dynamic approaches (O’Brien and Downing, 2013). Secondly the approach should be forward looking for CCA assessments that are across planning times (Birkmann et al., 2013). Thirdly, risk actors should have the ability to reorganise entitlements and resources (Pelling and Blackburn, 2013). In keeping with DRR-CCA frameworks, a risk governance framework was identified that would facilitate this approach and that could be adapted to the SIDS context. Specifically, the Adaptive Integrated Risk Governance (ARG) framework (Klinke and Renn, 2012) has strong elements of flexibility (Renn, 2005; Aven and Renn, 2010a; Wachinger et al., 2013) and learning to address uncertainty and changing baselines. It also incorporates polycentricity, and multi-layeredness. The ARG provides an overarching approach to risk governance as opposed to other approaches that focus on one methodology- e.g. MOVE for vulnerability assessment only (Birkmann et al., 2013); thus it was found to be a useful starting point for conceptualising the requirements for SIDS. In addition, it allows for the tracing of the risk governance through risk decision making processes while accounting for governance features; and this was identified as best for conceptualising day-to-day routine risk governance processes and structures for DRR-CCA. Given SIDS development constraints, the ARG is useful since it accounts for how the many actors, individuals, institutions, (public and private) collect, analyse, communicate and decide to regulate risks. The framework emphasises the processes, mechanisms, institutional arrangements, cultures and social dynamics which are used in the framing of risk issues (van Asselt and Renn, 2011). Notwithstanding, the thesis has identified three gaps in the ARG framework that limit its applicability to SIDS. These are 1) a limited systems approach, 2) limited development approach and 3) inadequate treatment of adaptive capacity in the risk governance framework.
7.2.3. HOW COULD A RISK GOVERNANCE FRAMEWORK INCORPORATE THE PECULIAR DEVELOPMENT CHARACTERISTICS WITH WHICH SIDS ARE ASSOCIATED?

The thesis contributes an enhanced conceptual framework called the EARG for DRR-CCA risk decision-making that addresses the peculiar development characteristics of SIDS. It does this through four additional features to the ARG framework. The first main contribution to risk governance frameworks for DRR-CCA in SIDS is a systems approach that permeates from the core of the decision-making process. In some applications of the ARG (e.g. planning) there is acknowledgement of interconnections and interactions in risks and the need to manage systems (Renn and Klinke, 2013) but this is not sufficient. The ARG also incorporates a learning and feedback approach (O’Brien and Downing, 2013). However, a central systemic approach in the framework for addressing the intricate connections between and within SIDS socio-economic and environmental systems is not addressed. A systems approach is needed that goes beyond feedback loops but should identify and address systems interdependencies, and interactions between human and natural systems. This approach is particularly important in SIDS, though it could be useful in other contexts where there are fragile systems to be addressed. Other governance frameworks than the ARG, such as the earth systems governance framework (Biermann, 2007) acknowledge the importance of addressing systems interconnections and dependencies however what the EARG offers is an enhanced risk governance framework within which to mobilise integrated decision particularly connected to the risk management process for risks concerning DRR and CCA.

Secondly, the thesis has identified that assessing adaptive capacity should be included as a new and pertinent stage in risk estimation stage of the risk governance framework for DRR-CCA in SIDS. Prior to this study, research on SIDS adaptive capacity was addressed through dynamic and learning approaches only (Renn and Klinke, 2013). These features of the ARG can help capture complexities of the SIDS systems-, which are helpful for identifying adaptive capacity. Assessing adaptive capacity is necessary in SIDS as it would allow for the identification of potential capacity to reduce or increase the system’s vulnerability to hazards. Furthermore some SIDS may have a higher ability to act collectively when faced by threats from climate variability and change (which is an element of adaptive capacity) (Adger et al., 2004) than other places (Cinner et al., 2012). This potential or the lack thereof that was missing from the ARG is now contributed through an enhanced framework for SIDS.

This thesis also contributes a third enhancement to risk governance frameworks. Previous work (Renn, 2015) on risk governance frameworks suggests that linear risks that is, those that can be estimated based on probabilities (and that have low scores for complexity,
scientific uncertainty, and socio-political ambiguity), do not require any adjustments in laws or policy making processes only complex risks. To this end, this thesis particularly looks at climate change and disaster risks that require adjustments such as more inclusive and deliberative approaches (Renn, 2015). What this thesis suggests however is that a joining-up of policies, plans, networks, institutions and structures related to development risk management entities across the various levels is needed for risk governance. This is an approach that has been suggested for DRR-CCA (Howes et al., 2015), though not previously suggested in the context of risk governance. The approach deepens environmental governance (Lemos and Agrawal, 2006) concepts that promote collaboration and partnership, for joined-up planning, visioning, networking, and sharing approaches. This joined-up approach counters the silo approach to governing DRR and CCA that is the modus operandi of international and national DRR and CCA frameworks. Frameworks at the regional level have started to refer to each other but what is needed is an agreed operational procedure for how funds are managed and decisions made about projects and priorities. This is understood within an approach of DRR-CCA that is suggested in this thesis where CCA is intercalated in a DRR approach rather than mutual integration that still maintains parallel DRR and CCA approaches.

This joined-up approach supports the fourth contribution by the thesis to risk governance frameworks, that is, an explicit development approach to risk governance. The ARG recognises different dimensions of vulnerability, and engages several stakeholders however; a development approach that strategically aligns the processes and roles for risk governance with development processes is missing though it is a recognised international priority of global frameworks for reducing risks. The thesis contributes a framework in which the development sectors should provide the means for the strategic positioning and implementation of risk governance processes and therefore drive systematic analysis and management of the causal factors of disasters - whether economic, social, or environmental (Djalante et al., 2013; Begum et al., 2014).

The four contributions to risk governance frameworks -systems approaches, adaptive capacity, joining up, and a development approach could also be important in other contexts for governing risks. The EARG’s focus on systems is an overarching priority in addressing environmental governance that extends this framework’s scope of application beyond SIDS, though the SIDS context has emphasised its importance in the context of the risk governance decision making frameworks. Furthermore the solutions provided through joining-up, development focused approaches and adaptive capacity assessment, are solutions that can
resonate with other developing country contexts, given the shared challenges of other developing countries of resource limitations, coordination and institutional failures.

7.3. OBJECTIVE 2 - TO EVALUATE THE EXTENT TO WHICH EXISTING DRR AND CCA INSTITUTIONAL STRUCTURES AND PROCESSES IN BARBADOS ALREADY EXHIBIT THE POTENTIAL FOR DRR-CCA INTEGRATED RISK GOVERNANCE

I now turn to the second objective of the research, in particular the research question, how do existing DRR and CCA institutional structures and processes in Barbados exhibit the potential for integrated risk governance? Furthermore it asked what are the existing DRR and CCA risk governance institutions and processes in principle and practice? how are features of DRR-CCA exhibited in structures and processes for risk governance in principle and practice? and what is the potential shown by interactions and interconnections across structures and processes for integrated risk governance as revealed by social network analysis?

The thesis answered these questions by examining the case of Barbados against the enhanced adaptive risk governance (EARG) framework for DRR-CCA that was developed at objective 1. The findings from the Barbados case highlight that though SIDS have generally limited potential, that smallness issues offer some advantages to DRR-CCA particularly related to dense networks for information sharing. Smallness issues related to small populations, limited capacity and resources seem to offer an interesting potential for wielding important DRR-CCA features such as polycentricity. The research highlighted the potential that intraregional organisations offer to SIDS polycentricity. The research also emphasised the importance of already established disaster management networks that could provide an essential basis for DRR-CCA risk governance. This therefore supports similar findings in other contexts such as from Australia (Howes et al., 2015) and Nicaragua (Rivera et al., 2015). Furthermore key brokers were identified through SNA that could be engaged in potential prospects for sharing information in the DRR-CCA process. This kind of approach to addressing DRR-CCA has not been undertaken prior. Another key contribution is the network approach taken by the study that helped identify governance weak points for targeted bolstering of key actors and their relationships. Additionally it contributes a SIDS risk governance perspective on the potential for DRR-CCA risk governance.

Notwithstanding, smallness issues related to limited resources and capacity and particular development vs. environment conservation pressures that are associated with small spaces
must be addressed to maximise the potential seen. The SIDS context will require additional support to jumpstart some of the adjustments needed for DRR-CCA.

7.4. OBJECTIVE 3 - TO ANALYSE THE CHALLENGES TO SUCCESSFUL DRR-CCA RISK GOVERNANCE IN BARBADOS AS A SIDS

Regarding objective 3, the research question asked, what are the DRR-CCA risk governance challenges in Barbados, as a particular SIDS context? Particularly, why do DRR and CCA risk governance challenges occur? And how does islandness influence them?

7.4.1. WHAT ARE THE DRR-CCA RISK GOVERNANCE CHALLENGES IN BARBADOS?

The study affirmed several challenges to DRR-CCA. These included issues with separate institutions for DRR and CCA that limited cohesion within and across sectors; that is, the laws, norms and policies, formal and informal networks, and institutional mechanisms for DRR-CCA (Begum et al., 2014). These gaps are also similar to findings in other Caribbean SIDS contexts when climate governance policy coherence is examined (Scobie, 2016). Scobie (2016) also showed that in the Caribbean context, joining-up and collaborative approaches are mindset issues that need to be addressed. What the thesis has highlighted is how gaps concerning shortfalls in DRR for addressing risk through policies, norms, standards and regulations for DRR (UNISDR, 2015a) could be a major hindrance. The thesis shows how unchanged perceptions of disasters that do not address disaster mitigation for example (Birkmann et al., 2010) as well as unchanged understanding of DRR beyond response rather than in the long-term can be a hindrance to DRR-CCA. The Barbados case also highlighted the challenge to DRR-CCA where risk reduction is still reviewed primarily as the responsibility of the disaster manager but not a part of day-to-day activities of development sectors (Gall et al., 2014). This challenge is not only a problem for Barbados, but the global trend of limited mandates for DRR and CCA across institutions, suggests that this could be a hindrance also in other contexts for DRR-CCA. In this regard solutions or prospects related to addressing the mind-set challenges will be applicable in other country contexts.
7.4.2. WHY DO DRR AND CCA RISK GOVERNANCE CHALLENGES OCCUR?

It was found that the absence of policy that favoured DRR and CCA could be traced to attitudes and mind-sets that did not make the shift from response and preparedness to an encompassing DRR risk management approach. This had the possibility of minimising the potential for smallness that included dense networks for information sharing. This thesis also highlights how missing socio-economic sector and community involvement could minimise DRR-CCA. Even in a small context there was missing community engagement- which highlighted communication and participation issues. Other key challenges identified were around limited arrangements for joining up and disconnections between agents in science, policy, and practice. In particular, social and economic practitioners were hardly involved.

7.4.3. HOW DOES ISLANDNESS INFLUENCE THEM?

So how did islandness influence these challenges? This could be linked to other challenges identified in the thesis such as a limited development and socio-ecological systems approaches to governing risk. Concerning the latter, islandness issues seemed to be playing a role with respect to capacity short falls. Secondly, islandness seemed to have a role in restricting development options and contextualising certain issues of governance such as enforcement. From another perspective limited awareness and consideration of islandness features such as ‘systems’ was a key challenge –there was limited consideration of development and socio-ecological approaches for governing particularly amongst political leaders and the ordinary person.

The constraints of space and how it restricts development options is not only limited to the Barbados case. Even in other Caribbean SIDS contexts that have different hazard profiles- e.g. St. Vincent which is a volcanic island, there are limited options for low risk development that are driven by severe space limitations and other historical social and economic factors (Wilkinson et al., 2016). This is to the extent that the physical development plan seems to drive development in very high-hazard zones. To address the risk space conundrum in places like St. Vincent and similarly applicable to Barbados, comprehensive approaches have been recommended that build the resilience of communities living in high risk areas, as well as proactive approaches (Wilkinson et al., 2016). This resonates with comprehensive disaster management frameworks like Sendai. In terms of how risk is assessed and characterised as well as institutionalised, however the St. Vincent case (Wilkinson et al., 2016) emphasises the need for interconnection of risks- which is part of the systems approach that is a core element of the framework promoted in this thesis as a critical point for moving forward with
DRR-CCA. This thesis also suggests that this approach should also catalyse an integrated governance approach to how risk is governed. Specific recommendations are discussed in the next section.

Perceived benefits of the small island context were not found to be strong enough to overcome some of the challenges around communication. It also seemed that the very potential of the kind of polycentricity displayed particularly through intra-regional organisation involvement was specifically challenged. This seemed to be related to unexamined and unclear roles of regional (intra-regional) organisations in providing support for risk governance though there was great potential for these organisations to assist SIDS.

In summary, this objective highlighted two new ways in terms of how contexts can play a role in challenging DRR and CCA specifically through, unadjusted mind-sets from response to DRR and the role of the islandness context. Additionally it contributes a SIDS risk governance perspective on the challenges for DRR-CCA risk governance.

In view of the potential for DRR-CCA decision-making that was identified and the challenges specified, the subsequent section discusses the prospects for DRR-CCA risk governance in Barbados. This is then followed by a discussion on the policy implications.

7.5. OBJECTIVE 4- TO MAKE RECOMMENDATIONS TO THE GOVERNMENT OF BARBADOS AND POLICY MAKING ORGANISATIONS WORKING TO ADDRESS DRR AND CCA IN SIDS

Based on the conceptual framework applied, the potential for, and possible challenges to DRR-CCA identified, this section recommends and discusses the prospects for establishing a DRR-CCA decision-making framework for Barbados and then in the broader context of SIDS. The question was asked, what are the prospects for a DRR-CCA development decision-making framework for Barbados? Furthermore, what are the policy and practical implications of the research findings for Barbados and implications for SIDS? These prospects are aligned with six main areas used previously to discuss mainstreaming DRR in development after Benson and Twigg, (2007) but are applied to frame the discussion on DRR-CCA prospects. These are 1) Building awareness- Unadjusted Mind-sets and Unfamiliarity with the DRR-CCA linkages and benefits 2) Legislation and Policy- broad legislation that could be applicable to risk governance 3) Enabling structures- ‘I don’t know how it is configured now, how it will
happen’- structural adjustments and forums 4) Funding and a Framework 5) Training, technical support and tools 6) Change in operational practice, Measuring progress, Learning & Sharing. The discussion concludes with an emphasis on a spatial tool that could be a key prospect for advancing DRR-CCA decision-making in Barbados.

7.6. PROSPECTS FOR BARBADOS

The prospects for an integrated DRR-CCA decision-making framework must address the deficiencies in risk governance highlighted in this research and should build on the potential identified. A six step pathway is proposed that is now discussed. Table 7-1 provides a summary of the pathway steps.
1. **Build awareness amongst sectors partners and the public to address the mind-set challenge** Focus on understanding DRR and CCA, and their connections from an operational perspective. Show that development choices can create, drive and minimise risk. Emphasise the roles of each stakeholder in risk governance for DRR and CCA (Paper 3); and provide incentives for DRR and CCA.

2. **Extend legislation to enunciate roles for risk governance for all stakeholders at all levels, as well as the modality for coordination, information management, and flexible arrangements** (Paper 2). Establish boundary organisations. Expand DRR policy to address the risk drivers and climate change adaptation; and incorporate the management of systems as a core principle (Paper 2 and Paper 3). This includes articulation of the regulations of the Emergency Management Act for each agency that has a role in the DRR-CCA (Paper 3), particularly the specific roles of community and social sector entities (Paper 2).

3. **Establish a champion, and supporting structure for DRR-CCA risk governance** that streamlines committees, departments and ministries. Remove duplication, and maximise smallness advantages for cooperation, and deeper analysis. Establish inter-ministerial working groups, a coordinating and technical forum for co-production of knowledge risk governance. Expand existing DRR preparedness and response networks and enhance vulnerable persons committee. Merge CCA and DRR structures as well as portfolios at the ministerial level.

4. **Combine financing for DRR-CCA risk governance** based on reconfigured budgeting of own funding for joined-up ecosystems, development and expenditure strategies; in addition to international lobbying for debt forgiveness and advocacy for a cohesive funding approach to DRR and CCA.

5. **Enhance Planning Support Systems (PSS)** that place systems at the core; that enunciate roles for risk governance and networks for sharing; and that measure and respond to adaptive capacity. The PSS should engage social and economic partners, be flexible to changing baselines, and provide outputs that are well linked to policy. Ensure clear deliberation protocols are inclusive and address uncertainty. Fix the PSS in institutional arrangements for forward planning for climate change. Provide support through training and establish connections with boundary organisations that can support the production and sharing of knowledge.

6. **Establish policies and build capacity for understanding interactions within and between ecological, social and or economic subsystems** (Lal, 2011) (Paper 2). Build competencies for deliberation (Paper 2) and policy for measuring progress and learning.
The challenge with unadjusted DRR mind-sets affects a number of the supporting elements for DRR-CCA. It seemed that mind-sets had not moved much beyond preparedness and response to risk reduction. This study highlights in particular the impact that the unadjusted mind-set has on the institutions, and resources. They influence how risk is understood (Renn and Klinke, 2013) as well as the kinds of measures that may be put in place to address it (Spiekermann et al., 2015). Limited institutions also affect the enforcement of environmental policy, minimises resources for and demand for risk management approaches. It also limits awareness and finances (Mora, 2009)- several of these resource constraints were identified in this study.

Other DRR-CCA studies (Gero et al., 2010; Djalante et al., 2013; Howes et al., 2015) have however not suggested a focus on addressing mind-set issues for integration however it will be key for moving forward in the context of Barbados. As well as is applicable in other Caribbean settings- mind-sets that do not yet have the collaborate and integrating planning mechanisms are a regional issue and will need to be addressed (Scobie, 2016) Building awareness will be essential to developing the shared policy vision for DRR-CCA and for making the informed legislative and policy adjustments necessary for DRR-CCA. Building awareness of DRR (Benson and Twigg, 2007) beyond preparedness is therefore proposed as a key prospect for advancing DRR-CCA. This should encompass the adaptive DRR integrated CCA thinking suggested in the EARG framework developed in this study (Paper 1). Particular gaps identified concerning the lack of understanding amongst decision makers, socio-economic sectors, and the ordinary person of how smallness and islandness issues threaten risk, including fragility of ecosystems and linkages with livelihoods must also be addressed. The Sendai Framework at Priority 3 provides a useful approach for building awareness that includes giving the business case and livelihoods protection perspective for DRR (UNISDR, 2015b). In addition, building awareness will need to be linked with strong incentives for DRR—(UNISDR, 2015b) and should also demonstrate the benefits of a linked DRR-CCA approach which for now is largely academic (Gall et al., 2014) and lightly addressed in international frameworks such as Sendai and UNFCCC. Further approaches for changing attitudes and practice will need to be followed up; however, political champions can help. For example, one of the study’s high level decision makers recommended the need for building awareness particularly to provide an understanding between the DRR and CCA disciplines (Chapter 6, Paper 3). Given the economic crisis in Barbados, incentives for integration such as more efficiency and minimised overlapping structures could interest the government. It is
expected that with increased awareness there would be impetus to make needed adjustments in legislation.

7.6.2. LEGISLATION AND POLICY - EXTEND LEGISLATION TO ADDRESS CCA, ROLES AND MODALITIES FOR COOPERATION

Addressing the issue of legislation is a key aspect for creating an enabling environment for mainstreaming DRR and CCA in development (Benson and Twigg, 2007; Birkmann and von Teichman, 2010). This enabling environment is also essential for prospective tools such as DSS to be successful (Roy, 2005). In view of the capacity and accountability issues that emerged in the study and the lack of specific legislation across the sectors that could address DRR and CCA risk governance, it seems appropriate that legislative adjustments need to be made. Often in the case of DRR-CCA studies, the need for integrated DRR-CCA legislation is raised (Rivera and Wamsler, 2014; Howes et al., 2015). Arguably this can remove ambiguities and obstacles for joining-up and sharing visions. While integrated legislation for DRR and CCA would be helpful for Barbados, what this study has shown is that fundamentally one of the prospects for Barbados should be to ensure that there are specified roles across all levels (international, regional, national and community) for risk governance in sectors that address both DRR and CCA. This is because Barbados’ case was one where specific CCA legislation is non-existent and DRR legislation is under-developed without the necessary sector specified roles for risk governance. This recommendation corresponds with the recognition by the lead DRR entity that the supporting ‘orders’ of the DRR legislation must be developed for other sectors (Paper 3). For example, for community organisations, and social-economic sector organisations such as the Ministry of Social Care and DEOS, as well as the Engineer’s Association, Environmental Protection; Culture, Poverty alleviation and NGOs-e.g. RedCross. Furthermore in line with broader international recommendations, besides disaster management departments, other ministries or departments must adopt policies, rules, standards and regulations to manage and reduce risk (UNISDR, 2015a; Manyena et al., 2013). There must be an extension of the various kinds of independent decision makers at different governance scales (Folke et al., 2005; Djalante et al., 2013). Specification of roles in legislation should also address polycentricity, and the gaps in coverage of the risk governance process which showed that key areas in pre-estimation, vulnerability assessment, hazard analysis, perceptions, risk characterisation and monitoring were inadequately covered. In addition, key principles for taking a joined-up and shared vision approach to tackling threats to vulnerable systems need to be incorporated and arrangements for co-management, public private partnership and private-social partnership should be established (Forino et al., 2015).
7.6.2.1. ENABLING STRUCTURES - ‘I DON’T KNOW HOW IT IS CONFIGURED NOW, HOW IT WILL HAPPEN’.

While legislative adjustments would help address DRR-CCA it is also clear that legislated roles aren’t always put into action because of issues with other enabling factors such as, accountability, capacity, tools and lack of operational adjustments (Benson and Twigg, 2007). A ‘supportive architecture’ around joined-up initiatives to facilitate implementation (Carey et al., 2015) is required. As one study participant indicated in Paper 3, ‘I don’t know how it is configured now, how it will happen’. High Level Decision Maker

As in other studies on DRR-CCA in SIDS, DRR-CCA seems to require a radical restructuring of institutions (Gero et al., 2011). Meanwhile in practice some SIDS have taken ministerial and policy adjustments (Gero et al., 2010; UNISDR and UNDP, 2012) and others have opted for coordinating committees that are externally funded (Nalau et al., 2016). The Barbados case also calls for similar adjustments. Some recommendations are provided on the kinds of adjustments that can be made at the committee, department and ministerial levels to respond to legislative changes. In addition, the recommendations also seek to remove duplication in the DRR and CCA structures that emerged from the study. As recognised in this study and other studies there are merits in building up already existing disaster networks to address CCA (Howes et al., 2015).

A. COMMITTEES AND STRUCTURES

The study showed that there was a multi-level network in principle but some exclusion and issues with coordination in practice; though a very dense network was found in practice for generating and sharing knowledge. Building on legislative adjustments for clarity on roles for all stakeholders for risk governance, it is proposed that the structure for DRR-CCA can be streamlined with the reconstitution of several committees in the existent structure. This would avoid duplication of membership for DRR-CCA and ameliorate issues with coordination and exclusion (Paper 2). This targets the Climate Change Committee and the Emergency Management Advisory Committee (EMAC) and its subcommittees. The adjustments in committees from a response focus only to DRR has already happened in places like Nicaragua (Rivera et al., 2015). Some suggested adjustments for Barbados include:

1. The Hazard Mitigation Committee (though not functional), and Coastal Hazards subcommittee should be merged to address DRR and CCA; as well as the committee for climate change. A working group could be established to provide updates on
climate change activities. Having an individual unit to address climate change or full time officials would not be the best use of scarce resources. Though this has been the global trend (Alber and Kern, 2008; Bassett and Shandas, 2010; Bulkeley, 2010), recent austerity measures even in developed countries are changing this trend.

2. The Vulnerable Persons Subcommittee that focuses on preparedness and response should be reconstituted and empowered to address vulnerability assessment as a whole and not only evacuating designated vulnerable people. Its role could include liaising with sectors to help them do their vulnerability assessments (VA); establishing procedures for VA and community based VA; including reviewing of methods such as MOVE (Birkmann et al., 2013); CRAM for risk assessment (Papathoma-Köhle et al., 2016); and how to address interlinked vulnerabilities to climate change per development and stakeholder priorities.

3. The DEM EMAC could be reconstituted to address DRR and CCA and could include energy, economic, water, investment and several other environmental entities now missing.

4. The climate change mitigation portfolio could be included under the remit of other ministries such as for business and energy- e.g. UK case.

As highlighted by one of the high level decision makers in the study, integration will need to go beyond sitting on administrative committees (Chapter 6, Paper 3). In order to facilitate this, prior recommendations concerning building awareness and ministerial and legislative adjustments have been suggested. It is expected that this could help also to adjust mind-sets and expectations concerning DRR and CCA. Ultimately organisations will need to streamline DRR and CCA into their day-to-day job roles. Some examples include multi-disciplinary working groups within organisations and ministries that could develop clear standards and goals, and monitor and evaluate adaptation targets (Birkmann and von Teichman, 2010).

From an operational perspective, where working groups may not always be possible, accountability should be engrained in job roles (Djalante et al., 2013; Rivera, 2014; Howes et al., 2015). Notwithstanding issues with a more hierarchical rather than polycentric and joined-up structure in practice for DRR and CCA need to be addressed. Centralised structures for disaster management have been associated with weak institutions and inadequate capacity for risk management (Mora, 2009). It is expected that there would be more
polycentricity through legislated roles but that a more coordinated structure is set up that goes beyond project driven meetings and the solidarity during times of response to crisis (Paper 3). The study showed that there are technical and human resource weaknesses that will need to be addressed. Leadership will be a critical part of making the necessary adjustments.

B. MINISTERIAL ADJUSTMENTS, PORTFOLIO COORDINATION STRUCTURE AND TECHNICAL FORUM

Ministerial adjustments are suggested to aid in minimising duplication and strengthening technical coordination. Some of the decision makers in the study suggested merging the Ministry of the Environment and the Department of Emergency Management (Chapter 6, Paper 3). However, given the importance to safeguarding SIDS systems and economies from climate related and disaster risks and the all-encompassing nature of DRR and CCA, it is suggested that both environment (in the Ministry of the Environment) and disaster management and other departments such as police (now in the Ministry of Home Affairs) be coordinated from the Office of the Prime minister. Furthermore, using a similar approach to Australia, ministerial level sub-committees may be established to create strong collaborative relations between the relevant portfolios such as DRM, climate change, planning, health (Howes et al., 2015) and other key sectors such as tourism. These subcommittees could also ensure there is compatibility and uniformity between goals, mechanisms, and procedures for joining-up (Carey et al., 2015). DRR-CCA and could be operationalized as reconstituted subcommittees of the EMAC discussed above. Additionally, political will helps to provide an enabling environment that is essential for mainstreaming (Benson and Twigg, 2007). It is therefore also recommended that a champion at the level of a Minister is needed. The current Minister for DRR expressed an interest in starting a discussion on DRR-CCA that could be followed up (Chapter 6, Paper 3).

The recommendations concerning improved coordination for DRR-CCA through ministerial subcommittees must also be further bolstered beyond joined-up visioning and planning, to also incorporate technical discussions on how it could be operationalized. Study participants suggested that the present architecture where the reporting is to the Permanent Secretary for the respective ministry (Environment as an example for climate change) does not facilitate the kind of technical coordination that is necessary (in Chapter 6, Paper 3). Instead as suggested by some participants, a technical forum was needed (Paper 3). In addition, it could support co-production of knowledge that is needed for DRR-CCA. In accordance with what
Spiekermann et al., (2015) suggests, both domains should enhance their efforts by providing arenas where knowledge can be shared and jointly discussed, thus transforming their boundaries into lively interfaces among scientists of different disciplines and stakeholders of all different groups that promotes feedback and communication verification (2015, p 101). Ministerial committees can also be utilised to remove the ambiguities and blockages between different polices to deliver integrated services and support partnerships creation across and within sectors, improve use of resources, improve conduits for sharing ideas, and cooperation between stakeholders (Howes et al., 2015). Legislative and political support would also support the removal of the structural obstacles of government hierarchy, jurisdictions, and duplication (Howes et al., 2015).

So far, a supportive structure that consists of committee reorientation, departmental and ministerial adjustments, and a technical forum has been suggested for a joined-up DRR-CCA approach for Barbados for risk governance. While the need for ministerial adjustment is necessary to ensure the coordination of budgets and expenditure, some suggest that decided effort at the operational level should rather be the focus (UNISDR and UNDP, 2012). Both are needed particularly for sustainability and to advance ideas such as joined-up expenditure (Howes et al., 2015). Further coordination issues also emerge with joining up (Hooghe and Marks, 2003) that will need to be addressed.

7.6.2.2. FUNDING AND A FRAMEWORK

Appropriate resourcing is necessary for joining up (Howes et al., 2015). This however is a challenge of the SIDS context. Ideas such as establishing a separate funding pool for cooperative initiatives on DRR-CCA as opposed to shared funding for DRR and CCA has been preferred in other non-SIDS contexts such as Australia (Howes et al., 2015). To set up a separate funding pool SIDS will need external support. SIDS however are facing dwindling overseas development investment funds. In this regard, SIDS financing from their own funds for addressing development issues has been posited as being more reliable and significant in quantity (Lal, 2011). In view of climate change impacts that are not necessarily from their own actions, looking to their own limited resources is controversial. Notwithstanding SIDS may consider reconfiguring the use of public resources for sustainable development (Witter, 2011) to maximise efficiency in how they address risks. Another prospect is to lobby for the expansion of adaptation funding that is being made available to address some of the governance restructuring that has been suggested so far. It is further recommended that Barbados adopts a framework to integrate development strategies, ecosystems based and
expenditure strategies (Lal, 2011) which has been a key recommendation for a sustainable development approach for SIDS but has not yet been taken up. It is also applicable for DRR-CCA where these are also incorporated in the joined-up approach. Other initiatives of CARICOM for debt forgiveness from the international community are also useful but the aim should include support for adaptation and reducing risk. Rather than pursing separate climate change funding mechanisms (Cashman et al., 2012) a cohesive funding approach to DRR-CCA seems more feasible. The literature points to the importance of targeting DRR interventions towards the private sector since it generates between 70–85% of new overall investment- much of which will be lost if there is little consideration of disaster risk (UNISDR, 2013). Private sector may need to have a role in financing DRR and CCA interventions that should be explored. Whilst funding is essential, other capacity issues will need to be addressed in view of the technical and human constraints identified in the study (Chapter 6, Paper 3). These are now discussed.

### 7.6.2.3. TRAINING, TECHNICAL SUPPORT AND TOOLS

Training and technical support have been associated with mainstreaming approaches (Benson and Twigg, 2007). This study has identified a comprehensive framework for risk governance that included steps such as addressing adaptive capacity (Petzold and Ratter, 2015). While gaps were identified in other areas, some of the capacity needs were not further investigated. Assessing capacity (technical, financial and administrative) as a part of the risk governance process for DRR-CCA risk governance will be necessary but has not emerged in other studies on DRR-CCA. The Sendai Framework for DRR however suggests that this is an important aspect of improving DRR (UNISDR, 2015b). In order to address capacity shortfalls, legislative adjustments, building awareness, training, institutional changes (UNISDR, 2015b); as well as new and improved tools that can also help to address shortfalls in technical capacity are needed.

With respect to legislative adjustments, suggestions have already been made in the foregoing discussion (section 7.6.2); as well as recommendations for building awareness (section 7.6.1), reorganising committees and in particular setting up a technical forum that could provide much needed technical support for DRR-CCA (section 7.6.2). Some of these adjustments can tackle some of the issues related to bureaucracy, hoarding information, and the absence of policies for sharing and generating risk information that were raised (Chapter 6, Paper 3). There were missing linkages between data collection, and issues with making data accessible to key agencies and decision makers (Chapter 6, Paper 3). Related to these shortfalls was a
gap in connecting policy with science and information on risk. This will need to be addressed since uncertainty of available scientific knowledge prevents decision-making (Wilby and Dessai 2010). In this regard an augmented planning support system (PSS) is suggested.

A. AN AUGMENTED SPATIAL TOOL FOR RISK GOVERNANCE IN BARBADOS

The development of tools are essential for ensuring DRR is mainstreamed (Benon and Twigg, 2007) and this is extended to ensuring that both DRR and CCA are mainstreamed. It is also in line with the Government of Barbados’ priorities as set out in the Growth and Development strategy for 2013-2020 (section 1.2), which recognises that approaches to building climate change and economic resilience will require- sophisticated tools for decision-making that change attitudes towards risks and uncertainty (GOB (Government of Barbados), 2013c, p.88). In particular, I look to Planning Support Systems (PSS) that can facilitate multi-stakeholder discussions and engagement in an integrated, multidimensional and multi-disciplinary framework (Kasemir et al., 1999; Ravetz, 2000) as discussed at section 2.8. This thesis highlights the importance of having the context of risk governance reflected in the PSS. The adjustments suggested concerning institutional structures, legislation and building awareness help to provide an enabling environment for tools that can make information more accessible for decision making. Without these adjustments the tools alone will not work (see section 2.8.1). PSS tools could also provide a platform for addressing the weak science policy interface for DRR-CCA that was identified in this study. The platform is essential for strengthening DRR-CCA requirements for collaboration and networking between research agencies and universities, nationally and internationally, local governments and communities, (Djalante et al., 2013, p.2118). As introduced in section 2.8, PSS can build bridges between the scientific community, decision-makers, and disaster management communities. The platform could also address communication gaps between socio-economic sector partners and other mainline risk managers that were identified in this thesis, so that they can contribute to adaptive risk governance planning. Indeed communicating structures are necessary to keep social type actors informed – community based organisations, NGOs, ‘vulnerable groups’ and market actors (tourism for example) (Ostrom, 2010a)- a spatial tool could help with this. Furthermore in countries such as Barbados where the generation and storage of knowledge has not yet been carried out systematically, such a platform can aid information exchange for different actors including those at the international (Birkmann and von Teichman, 2010; Djalante, 2013). It is therefore not surprising that national and regional partners have also sought or are seeking to establish information sharing platforms that address some of these needs for Barbados and other SIDS (see Chapter 6). These include platforms such as CARICOF by CIMH that facilitates outlooks on specific climate measures (e.g. temperature, rainfall, and
drought) for decision makers (a necessary step of the early warning aspect of risk governance described in Paper 1, Chapter 4). Other platforms such as the Caribbean Risk Information System (CRIS) by CDEMA, is concentrating on consolidating available risk management information for CARICOM states including Barbados. At the national level the NCRIP allows for consideration of disaster and climate change risk in coastal planning. The challenge with these tools is that other aspects of risk governance for DRR-CCA are not addressed. Specifically:

1. Systems are not placed at the core of the decision support system. This means that the overlapping systems and interactions of the different concerned stakeholders are not looked at specifically to see how the threats affect the systems that they manage—social, economic or environmental.

2. The decision support systems are not governance focused that is, they are not responding to the role of supporting institutions, their capacities, networks and resource availability, and capacities to adapt.

3. Joined-up governance is not the operational perspective to govern the process of making decisions about risk around the decision support system.

4. Modalities for engaging across the different centres or jurisdictions around risk are not clear; and roles of stakeholders across the various levels of stakeholders, be they at the national, regional and community level are not factored into the decision support system.

5. The operational capacity to feedback information based on changing baselines of vulnerability over time and to reorganise resources and entitlements is not present.

6. The role of social partners and economic partners is unclear.

7. Scientific information on climate change impacts is not sufficiently linked to the process for managing risks.

8. Processes for deliberation are unclear.

9. There is limited specific and visual information to guide the decision making process.

10. Present institutional arrangements are not designed to provide the forward planning for climate change far less present extremes e.g. flooding.
In the next section, I suggest how currently available or planned spatial planning and support systems such as NCRIP and CARICOF could be adjusted to respond to these gaps.

B. DETAILS OF THE ADJUSTED TOOL

Both CARICOF and NCRIP have been described as central and accessible knowledge management platforms. These systems could be enhanced for DRR-CCA. This is discussed from the perspective of: 1) the positive aspects of the existing tools, 2) how the negatives concerning the tools (as raised in the previous section A) are addressed, and 3) what would be necessary to make the current tools successful with an emphasis on the distinctive features of the enhanced PSS tool for DRR-CCA.

I. THE POSITIVES

Often limitations in resources and data minimise the data that can be available for PSS (Papathoma-Köhle et al., 2016), and this is the case of Barbados. To respond to this gap, platforms are being set up to host information such as DEWETRA (UNDP, 2014) and to collect routine data (NCRIP). Others such as CARICOF combine experiential and spatial tools, which are needed for a DRR-CCA approach (Tran et al., 2009; Serrao-Neumann et al., 2015) for comprehensive risk assessments in the face of uncertainty. What may be necessary is to evaluate the availability and gaps in data; maximise methodologies that could be used in data scarce environments; and identify additional data required for future development (Papathoma-Köhle et al., 2016). For example it was found that data was being collected on flood points (from the Drainage Division) but not in a spatial system, which could be maximised.

A test case was undertaken to illustrate the point. The main purpose was to determine whether the Complaints Journal (CJ), which is a hard copy journal of tabulated drainage complaints compiled from telephoned calls from members of the public to the flood management agency (Drainage), could be a useful means for providing information in a spatial DSS for integrated flood risk reduction and adaptation. The data available in the CJ comprises of a date, address of caller and description of the complaint. This information is used by the Drainage Division to respond to flooding complaints and not for risk reduction. The information was used to create a flood complaints maps. This was done by adding the details on flooding into an excel spread sheet with four pre-assigned categories: Affected (A1-A5); flooded impacts (F1-F3); drain state (D1-D6); health impacts (H1-H2). Appendix 13 has more details on these categories. Table 7-2: Process for Developing the Flood Complaints
Map and Table 7-3 illustrate how the data was used to make a flood complaints map that could be used in planning for risk mitigation. The Flood complaints map is shown at Figure 7-1. The database used to develop the map could be queried to find trends in flooding (clusters/ hotspots). Queries could include identifying hotspots related to types of flood problems; and to time and type of flooding. The map could also be overlayed with a rainfall data layer for the period to look for trends in time and location that may have been associated with specified flood events.
<table>
<thead>
<tr>
<th><strong>Rationale</strong></th>
<th>There are untapped sources of data collected for alternative purposes but which could be transformed to give a sense of areas experiencing flooding</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Raw data format</strong></td>
<td>Hard copy journal of tabulated drainage complaints compiled from telephoned complaints from members of the public</td>
</tr>
<tr>
<td><strong>Information provided</strong></td>
<td>Date, address, location and description of complaints concerning drainage</td>
</tr>
<tr>
<td></td>
<td>Available for an eight year period</td>
</tr>
<tr>
<td><strong>Case</strong></td>
<td>359 complaints for one year which corresponds with flood events in August, 2014. (April 2014 - April 2015)</td>
</tr>
<tr>
<td><strong>Extract Spatial Information</strong></td>
<td>The ‘complaints’ column and 'address' column of the caller provides information on the location of the problem.</td>
</tr>
<tr>
<td><strong>Generate Geolocations of Flood Complaints</strong></td>
<td>Translate complaints into an electronic spreadsheet for import into the GIS</td>
</tr>
<tr>
<td></td>
<td>Assign coordinates by point for each complaint and inserting points on a roads GIS layer (resolution is 0.4m).</td>
</tr>
<tr>
<td></td>
<td>Generate main flood categories to code the complaints received.</td>
</tr>
<tr>
<td></td>
<td>Assign to four categories: A1-A5: Affected ; F1-F3: flooded ; D1-D6- drain state; H1-H2- health</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Date</th>
<th>Address</th>
<th>Complaint</th>
<th>No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>19 June 2019</td>
<td>Church Street, Speckton, or Peter</td>
<td>Drain and Sewer blocked up main is not working.</td>
<td>125</td>
</tr>
<tr>
<td>13 June 2019</td>
<td>almond Bay Hotel, Westing ch.</td>
<td>Drain by almond Bay Hotel, leading to pond which needs urgent attention.</td>
<td>126</td>
</tr>
<tr>
<td>17 January 2019</td>
<td>Fairfield block rock st Richard</td>
<td>Treated needs clearing and block up water outlet flow &amp; rain fell the place flood out</td>
<td>127</td>
</tr>
<tr>
<td>20 June 2019</td>
<td>Woolding st Philip</td>
<td>Drain and water censored &amp; block up outlet &amp; house is flood out</td>
<td>128</td>
</tr>
</tbody>
</table>

Drain and water combine to block up and when rain falls by house is flood out.
Map Showing Flood Complaints

Legend
- Flood complaints
- Roads

FIGURE 7-1 FLOOD COMPLAINTS MAP
II. ADDRESSING THE NEGATIVES AND MAXIMISING THE POSITIVES FOR SUCCESS

To address the gap with respect to unclear roles for different stakeholders who are operating across jurisdictions, scales and sectors it is recommended that roles for undertaking each aspect of the risk governance process in the Decision Support Systems (DSS) are articulated for all sector actors (based on section 2.8.1), particularly socio-economic sectors and those at the different levels, community and upward. This could also help to bring clarity to how regional spatial DSS could interconnect with the national level decision support systems. Particularly for the NCRIP it should consider roles for all stakeholders across all the sectors as articulated in the conceptual framework in Paper 1.

The CARICOF presents a useful starting point for a deliberative process around using risk information- it brings different stakeholder country representatives together to discuss the threat and to agree on recommendations for action at the regional level. NCRIP is still under development but it is not clear how deliberation around identifying what are the risks and handling disagreements on acceptable risk levels will be settled. The process of making the maps will be as important as the maps themselves (Tran et al., 2009). A number of participants suggested that the round tables for example that deal with environmental risk assessments were adequate. The challenge is that this kind of deliberative approach only extended to large developments and did not deal with other risks. Furthermore climate change was one hazard not yet tackled. Improving the deliberative process so that it was clear was a critical point for improvement that emerged (Paper 2, Chapter 5). This can also lead to a more transparent tool regarding uncertainty and the limits of knowledge and inclusiveness that affect sharing (Spiekermann et al, 2015). Deliberative approaches can also enhance people’s flexibility and readiness to deal with and adapt constantly to the “unexpected” (Birkmann and von Teichman, 2010). It is recommended that transparency be a key aspect of deliberation in the sharing platform and; information, communication and participation should be enhanced to avoid the pitfalls concerning under usage of Planning Support Systems (section 2.8.1).

One of the emerging perspectives from the study is that information on response, risk reduction and adaptation should not necessarily be separated (Paper 3). Rather the tool should make connections with having information prioritised for improved readiness (e.g. shelters, evacuation) and response as the modality for reducing risk; it should also include information needed to identify drivers of risk. Furthermore to address the gap on how systems are considered, the NCRIP must put systems at the core of the decision-making
platform. The rigour of the risk assessment could also be strengthened for Barbados by addressing systems interactions and vulnerability. This should coincide with building awareness on systems as mentioned at section 7.6.1. The PSS will also need to incorporate measures of assessing adaptive capacity. Based on the literature and findings from the thesis, possible desirable features of the PSS further to stakeholder input are captured in Figure 7-2.

![Figure 7-2: Desirable Features for SIDS PSS](image)

### III. SUSTAINABILITY OF THE TOOLS

All of the current platforms have been established through the support of external funding and this may continue to be the way forward for SIDS like Barbados. Barbados could seek external assistance to expand the NCRIP to a spatial methodology that incorporates the gaps identified for a more routine approach toward integrated disaster risk reduction and climate change adaptation (DRR-CCA) decision-making. Preliminary data is available from the thesis that could help develop a prototype. Background information is available on the perceptions of organisations concerning roles for DRR and CCA; the characteristics of an effective CCA and DRR flood risk governance process; and the characteristics of an integrated DRR-CCA spatial decision-making tool for flood management in Barbados. It would be an improvement to the NCRIP, if a coordinated approach that reaches beyond a data sharing policy or the sharing of raw information only was applied. In particular, participatory elements of the tool could be
developed and tested. It will be important to have people involved in the process iteratively for developing the tool since they hardly may know what they need and want at the very beginning (Volk et al., 2010). This can in its own right promote sustainability (Vonk, 2006). Spatial DSS and PSS can suffer from under-usage which may be related to design issues, instrument quality, diffusion and acceptance challenges as discussed at section 2.8.1. These must be avoided. As this study has shown, there are numerous organisational issues that need to be addressed for DRR-CCA and these will also affect the PSS. Issues concerning, perceptions, attitudes and knowledge, as opposed to the technical issues can really hinder the PSS (see section 2.8.1). In this regard the recommendations on legislation (7.6.2) and building awareness (7.6.1) will be crucial for going forward. Building awareness on DRR-CCA roles can help stakeholders know the kinds of information they need to carry out their roles. Other supporting requirements of the PSS such as information policies, sharing rules, and the requisite structures should also be accounted for as discussed at section 2.8.1 (Mansourian et al., 2006). Based on this thesis the platform should be supported by policies for joining up institutions and policies. Participants also felt that a forum or even a ministry that could consolidate the necessary information was needed. It was suggested that departments such as data processing could be reorganised to manage information for risk governance (Paper 3, Chapter 6). Training can also help individuals understand responsibilities on collecting and updating data sets (see section 2.8.1 and (Mansourian et al., 2006)).

Thirdly, it would also seem that given the SIDS landscape, that universities and research centres at the intraregional level, which serve multiple countries should be strengthened, as regional cooperation is important for sustainable development (Harris and Hope Khonje, 2011). It is recommended that regional organisations such as CIMH, UWI, and CDEMA play a key role in strengthening the technical shortfalls more so than they do now (they too should access external funding to address their own incapacities). Issues with unclear expectations on roles particularly with regional organisations should be clarified and their roles augmented for better service. Examples such as the climate outlook forum (CARICOF) at the regional level led by CIMH shows what can be done. SIDS like Barbados could also consider establishment of a joint centre to address risk assessments—such as the UWI Disaster Risk Reduction Centre—funded by UNDP but hasn’t delivered much in recent years.

Finally, boundary organisations (Guston, 2001), could be established – which for now are missing from the Barbados landscape (Paper 2, Chapter 5). Boundary organisations are forums for actors to reach mutual understanding (Corfee-Morlot et al., 2011), for example, a forum for scientists and decision makers (Guston, 2001). Boundary organisations have been
identified as an important component of adaptive DRR-CCA networks (Djalante et al., 2013) and are closely interlinked with knowledge/information and learning that is necessary for DRR-CCA. As mentioned in section 2.5.2 they can help improve the usability of information for risk governance and strengthen technical capability (Kirchhoff et al., 2013; Mauelshagen et al., 2014); and in this regard they could help strengthen the technical support that is necessary for mainstreaming (Benson and Twigg, 2007).

So far a number of prospects for improving technical support have been suggested that have centred mostly on improved spatial knowledge platforms, building awareness, making use of regional organisations and the establishment of boundary organisations. To conclude this section, important adjustments in operational practice that are needed are reviewed.

7.6.3. CHANGES IN OPERATIONAL PRACTICE, MEASURING PROGRESS AND LEARNING

Changes in operational practice are the next level towards seeing DRR-CCA mainstreamed. Firstly, it would seem that the core adjustment needed is for systems and their human-social and environmental interactions and connections (O’Brien and Downing, 2013), to be placed at the centre of operations. It is recommended that measures to raise awareness seek to move beyond environmental entities only. The limited uptake of a systems approach has been linked with SIDS limited capacity in understanding interactions within and between ecological, social and or economic subsystems (Lal, 2011). It is therefore recommended that capacity and awareness is built in this area, and this understanding should permeate legislation and policy. Guidance on how to incorporate the systems perspective across time and within varying scales of assessment and action in each step of the risk governance framework, for example can be found in Lei and Wang, (2014); and Patahoma-Köhle, Promper and Glade, (2016).

Secondly, the most significant adjustment would be to establish the mechanisms for deliberation (Paper 2, Chapter 5) for DRR-CCA risk governance. A number of challenges were identified around ambiguity of the goals and on communication of risk issues and methods for reaching agreement as well as missing perspectives with clear legislation, policy and procedures (Paper 2). So far, a policy for deliberation has been suggested for risk governance that could allow deliberation to move beyond the EIA process alone. It is further suggested that the technical hub recommended in the previous section on enabling structures (7.6.2.1),
could facilitate necessary round tables or other methods e.g. advisory committees to openly discuss competing arguments, beliefs, and values which is particularly important when dealing with complex risks (Renn, 2008). The process of identifying overarching common values, and in defining options that don’t compromise the vision of others, is at the crux of resolving conflicting expectations (Renn, 2008). Finally, measuring progress and learning would be essential for a mainstreaming approach to take place (Benson and Twigg, 2007; Nalau et al., 2016).

7.6.4. POLICY IMPLICATIONS

A number of bold and paradigmatic changes have been suggested that challenge the status quo at the national and international levels. These are in line with the recognised need for regulatory, legislative, financial, technological, or biological system transformation after the IPCC in DRR to address CC (IPCC, 2013). The broader Caribbean Regional Climate Change Plan also aims to develop a risk management ethic in decision-making in Caribbean States. This Plan recognises that, ‘a transformational change in mind set, institutional arrangements, operating systems, collaborative approaches and integrated planning mechanisms are essential for delivering the strategic elements and goals of the Regional Framework [for achieving development resilient to climate change].’ (CCCCC, 2011, p.19). Many of these changes may need to be incremental however. Initial reviews of the joined-up DRR-CCA risk governance approach suggested for SIDS in this thesis have recommended that it may seem too complex and a heavy burden for SIDS with limited resources. This is because in well-resourced environments it is not easy to accomplish stakeholder involvement, and polycentric decision centres. Indeed SIDS have scarce local skills and human resources, high per capita costs for infrastructure and services, and they have few opportunities for economies of scale, and fragile ecosystems. Notwithstanding, from a physical perspective, small population, small geographic size, could allow them to do things in a more coordinated way. Initial seed funding would be helpful to get the approach going in SIDS, however what it requires is a restructuring of SIDS governance arrangements and reform that would allow them to do things better and smarter. It also means more coordinated use of funding for DRR and CCA. SIDS may not be able to individually afford a centre for early detection of their hazards etc. but through joint regional efforts they can. They can maximise their smallness however, their traditional structures need to be reformed. This way SIDS can build on the positive characteristics. It is not without its challenges particularly for management (Carey et al., 2015) but the SIDS smallness context could prove to be a successful case. Islands are small laboratories representing microcosmic examples of processes at larger scale Baldacchino (2004, 2007) in (Christensen and Mertz, 2010) if it can be done here, then larger processes
could potentially be addressed. It will involve transformation of management approaches, piloting that may include demonstrable projects that can test the governance arrangement that is suggested in this thesis. Barbados can maximise its high adaptive capacity and smallness potential through the use of explorative approaches which seem to help in other contexts (Wejs, 2014). Additional resource help from external sources will also be needed to jump-start the approach.

It is anticipated that the six step pathway Table 7-1 responds to Barbados’ specific development characteristics- recognising historical challenges such as poor public sector history and hierarchical approaches, as well as spatial issues of space for development, given smallness and weak institutional settings (Assmuth et al., 2010; Boholm et al., 2012). It is hoped that the prospects suggested here can help to make DRR-CCA a reality- helping to move from abstract to practical suggestions for DRR-CCA (Gall et al., 2014).

The present economic climate in Barbados is worsening and austerity measures continue to rise (section 2.6.1.). The reality however as the Barbados Finance Minister indicated is that, *Barbados cannot take any shock at this time---or it will crumble* (Nation News, 2017). Urgent steps must be taken to address the challenges and initiate sound integrated approaches. As mentioned at section 4.4.2. DRR-CCA promises 1) more efficient use of both human and financial resources 2) consolidation of information and decision-making processes to understand and address vulnerabilities. 3) More efficient CCA policies that build on existing DRR efforts and tools (Lei and Wang, 2014). Joining up can help to maximise the potential benefits of established DRM networks (Howes et al., 2015). DRR-CCA is an investment that should not be ignored. Given the complexity and diversity in SIDS a ‘one size fits all approach’ to reducing vulnerability must be avoided (Connell, 2013; Nurse et al., 2014). What has been suggested here is a framework with necessary components—the details of which would need to be adjusted to suit the individual SIDS specific context.

### 7.6.4.1. TRANSFERABLE LESSONS OF THE CASE

The six step pathway Table 7-1 responds to specific challenges that were found in Barbados, the question to asked when assessing what is transferrable about this case is whether other SIDS are countries experience similar challenges; and whether the solutions proposed require similar governance structures as those in Barbados to be appropriate in these other contexts. While this research has not investigated other country contexts it would seem that given known gaps discussed on making the systems connections and development drivers of
risk, and gaps on stakeholder roles, as well as the fact that work (Scobie, 2016) looking at policy coherence in the Caribbean has highlighted challenges related to mind-sets to coordination and cooperation that step 1- building awareness is a point for consideration by those seeking to undertake DRR and CCA policy implication. Specifically, for regional CDM strategy implementation it means that the sector mainstreaming approaches and community resilience priorities should incorporate the awareness building considerations suggested in this thesis.

The second and third steps of the framework focus on legislation, role specification, modalities for coordination, information management, flexible arrangements that include boundary organisations, and joined up resourcing that provides a practical way to advance with DRR-CCA coherency in policy and implementation. As this study has shown other countries are facing similar challenges as Barbados and therefore although the specifics for coordination are not directly transferrable. The lesson to be drawn is that specifics on cooperation and flexibility must be articulated. Regional institutions like CDEMA recognise the need to improve how climate change is incorporated in the policy and regulatory frameworks (CDEMA, 2014). The findings from this study suggest that in the process of articulating what the new national DRR structure should look like that climate change should be seen as another hazard, awareness built and persons are trained in how to incorporate it and consider how it affects the changing vulnerability baselines, and adaptive capacities etc. The legislation for DRR should suggest that it also connects with CCA—and it should not be stand alone. There should also be some measure of accountability through the specification of roles particular with attention to community engagement. Legislation should also address polycentricity, and the gaps in coverage of the risk governance process which showed that key areas in pre-estimation, vulnerability assessment, hazard analysis, perceptions, risk characterisation and monitoring were inadequately covered. In addition, key principles for taking a joined-up and shared vision approach to tackling threats to vulnerable systems need to be incorporated and arrangements for co-management, public private partnership and private-social partnership should be established (Forino et al., 2015). Countries could consider how sectors can use their own processes—planning, integrated water management to incorporate an integrated DRR-CCA- paying special attention to social partners. The relevance of this cross-sectoral approach pervades the regional and international DRR frameworks.

The Barbados case resulted in very specific recommendations on how to remove duplication and the kinds of supporting structures that are needed to support cooperation, and deeper
The point made by one of the high level decision makers in the study, that integration will need to go beyond sitting on administrative committees is a poignant one for many SIDS. Though specific examples such as inter-ministerial working groups may not be applicable in other contexts that have other governance contexts, the point is that there needs to be coordination at these levels and a technical forum for co-production of knowledge risk governance. It also highlights the points drawn from other work on maximising and expanding existing DRR preparedness and response networks and the role for potential vulnerable persons committee. These principles are also applicable for those organisations such as CDEMA, the UNFCCC and UNISDR that are pursing sector mainstreaming of DRR and CCA.

The use of PSS is growing and they can provide essential support for knowledge management priorities in SIDS and are already providing a supportive role and are already being used by some of the regional organisations in this study. This suggests that in setting out the DRM knowledge network for the Caribbean that brokers of knowledge and clear roles for how they can support national systems is articulated. There is a role for integrated PSS for fact based policy and decision making.

Finally a critical transferrable lesson relates to the final step of the pathway which looks at establishing policies and building capacity for understanding interactions within and between ecological, social and or economic subsystems (Lal, 2011) (Paper 2). Also building competencies for deliberation; and for measuring progress and learning is key gap that has been found in other SIDS contexts and therefore this prospect may be applicable for consideration in other SIDS.

The way in which the prospects suggested here are implemented will vary depending on specific implementation contexts but the guiding principles are applicable to several other contexts as has been discussed.
7.7. LIMITATIONS - METHODOLOGICAL LIMITATIONS OF THE STUDY

1. From a methodological perspective, only one case study was conducted. Concerns regarding the bias of the case approach towards confirming the researcher's preconceived notions (Diamond (1996)) may be allayed since the case study has been shown rather to contain a greater bias towards falsification of predetermined ideas than towards confirmation (Flyvbjerg, 2006). Preconceived notions may have derived from the researcher's positionality (at section 3.7.1) as a Barbadian and former regional and national practitioner in disaster risk reduction and climate change adaptation. This had its pros and cons. Pros from the perspective that it provided a gateway to informants and building rapport quite easily. In some cases where data was missing, familiarity of the researcher with the DRR and CCA networks allowed for some gaps to be filled. The researcher's positionality also facilitated a search for deeper meanings in interviews and data analysis particularly when they didn't match up with what was experienced. Notwithstanding being a researcher meant that participants would have still been careful about what they said—there is a notion when it comes to documenting things that people still would be cautious, particularly public servants. To avoid bias, transcripts were transcribed word for word, they were coded systematically and principles for analysis were applied to avoid cherry picking.

2. Another case study would be beneficial for comparative research and could strengthen the application of the arguments presented. There could be a focus on Atlantic and Indian Ocean, and Pacific Region SIDS. The work on how island features influence challenges of DRR-CCA risk governance is the first for SIDS. As more work is done we can begin to deepen our understanding of the similarities and differences that island contexts and governance arrangements from Caribbean and other island contexts offer.
1. The framework and prospects suggested in this thesis should be tested to see how it could perform in reality in view of competing initiatives, and the lack of common views among participants (Baird et al., 2016). The research done in this thesis does take these issues into consideration however; testing some of the mechanisms suggested would help to build the case for adoption in Barbados and other SIDS. In resource rich contexts it has been found that, "the context of climate change adaptation may require a different social network structure and processes than other contexts for adaptive co-management to occur" (Baird et al., 2016, p.747). We will not know for sure what this is until it is tested.

2. It is expected that with a single island case, like Barbados that it would be easier to galvanise governance of integrated DRR-CCA. It is notable that 60% of the SIDS identifying with islandness, stateness and smallness are multi-island states. Hence not all the findings from this case study are directly transferrable though Barbados provides a good starting point to consider potential challenges which could be reasoned to be compounded in a fragmented island reality. Future research can compare any differences with multi-state contexts.

3. The framework presented examined the macro context of risk governance and did not delve into the micro networks and stakeholders that support the sector systems responsible for planning, poverty reduction and environmental conservation. This has implications for the kinds of polycentricity that may be observed. Future research can provide a deeper examination of how these micro networks can function in SIDS contexts for DRR-CCA risk governance. This could extend to examining the networks involved in managing transnational resources such as fish and sea turtles, (Chen and Ganapin, 2016) from the DRR-CCA risk governance perspective. As well as a deeper analysis of how organisations, in the micro-systems, their standards, behaviours, risk perceptions and values affect the DRR-CCA risk governance process (van Asselt and Renn, 2011).

4. This thesis has provided an overarching framework for SIDS and Barbados specific prospects with broad policy suggestions for DRR-CCA that suggest that there should be a focus on ensuring that there is a clear understanding about DRR and what it means for development laws that address DRR and CCA. This can be through streamlining committees, and technical forums. Roles for risk governance, and tools and approaches
that place systems at the core as well as clear arrangements for deliberation, with a special focus on social and economic actors are needed. These are useful recommendations for all SIDS. However how these policies could be applied across the SIDS will differ based on resources available, and governance styles which have implications for how polycentricity may be tapped into. Some SIDS have hereditary chiefs, mixed NGO and government leadership (Kelman, 2016). Furthermore, this research has suggested a key role for intraregional organisations such as the CIMH that could help provide technical support for DRR-CCA. However, while other SIDS regions like the Pacific may have similar arrangements, other regions do not. SIDS also have different cultures that may influence variations in how the policy suggestions could be implemented. Future research could examine how prospects may change depending on these contexts, and would strengthen the arguments for the adoption of the polices suggested in this thesis, across SIDS.

5. Further research can be applied to learn more about how key actors may affect the potential seen for DRR-CCA and to see how it could be predicted based on attributes like being a government entity, or being a DRR vs. CCA institution, or based on legislated risk governance functions. SNA could also investigate whether different kinds of relationship networks- based on experience, or technical advice favour the DRR-CCA approach or not.

6. The planning support systems tool prospect for Barbados seems to provide an opportunity to bring DRR and CCA stakeholders together for DRR-CCA risk governance and builds on a number of initiatives underway. It can provide a catalyst for a number of the recommendations provided and could be a concrete way to move forward DRR-CCA. Further research is needed to build the tool based on the suggested adjustments and to test it.


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UN (1994) *The Barbados Programme of Action for the Sustainable Development of*


Switzerland.


## APPENDIX 1. PRAGMATIC LIST OF SIDS

<table>
<thead>
<tr>
<th>Region</th>
<th>Population</th>
<th>Area (km²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caribbean</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Antigua and Barbuda</td>
<td>91,295</td>
<td>440</td>
</tr>
<tr>
<td>Bahamas,</td>
<td>392,718</td>
<td>13,878</td>
</tr>
<tr>
<td>Barbados</td>
<td>277,821</td>
<td>439</td>
</tr>
<tr>
<td>Dominica</td>
<td>72,660</td>
<td>750</td>
</tr>
<tr>
<td>Grenada</td>
<td>109,590</td>
<td>348.5</td>
</tr>
<tr>
<td>Jamaica</td>
<td>2,950,210</td>
<td>10,991</td>
</tr>
<tr>
<td>St. Kitts and Nevis</td>
<td>54,961</td>
<td>261</td>
</tr>
<tr>
<td>St. Lucia</td>
<td>184,999</td>
<td>617</td>
</tr>
<tr>
<td>St. Vincent and the Grenadines</td>
<td>109,643</td>
<td>389</td>
</tr>
<tr>
<td>Trinidad and Tobago</td>
<td>1,349,667</td>
<td>5131</td>
</tr>
<tr>
<td>AIMS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cape Verde</td>
<td>525,000</td>
<td>4,033</td>
</tr>
<tr>
<td>Comoros</td>
<td>798,000</td>
<td>2,034</td>
</tr>
<tr>
<td>Maldives</td>
<td>393,253</td>
<td>298</td>
</tr>
<tr>
<td>Mauritius</td>
<td>1,348,242</td>
<td>2040</td>
</tr>
<tr>
<td>Sao Tome and Principe</td>
<td>190,428</td>
<td>964</td>
</tr>
<tr>
<td>Seychelles</td>
<td>92,000</td>
<td>459</td>
</tr>
<tr>
<td>Pacific</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fiji</td>
<td>909,389</td>
<td>18,274</td>
</tr>
<tr>
<td>Kiribati</td>
<td>103,500</td>
<td>811</td>
</tr>
<tr>
<td>Marshall Islands</td>
<td>53,376</td>
<td>181.43</td>
</tr>
<tr>
<td>Micronesia (Federated States of)</td>
<td>106,104</td>
<td>702</td>
</tr>
<tr>
<td>Nauru</td>
<td>10,084</td>
<td>21</td>
</tr>
<tr>
<td>Palau</td>
<td>17,948</td>
<td>465.55</td>
</tr>
<tr>
<td>Papua New Guinea</td>
<td>7,059,653 (was 5M in 2000)</td>
<td>462,840</td>
</tr>
<tr>
<td>Samoa</td>
<td>192,342</td>
<td>2,842</td>
</tr>
<tr>
<td>Solomon Islands</td>
<td>642,000</td>
<td>28,400</td>
</tr>
<tr>
<td>Timor-Leste (Democratic Republic of)</td>
<td>1,167,242</td>
<td>15,410</td>
</tr>
<tr>
<td>Tonga</td>
<td>103,036</td>
<td>748</td>
</tr>
<tr>
<td>Tuvalu</td>
<td>10,640</td>
<td>26</td>
</tr>
<tr>
<td>Vanuatu</td>
<td>286,429</td>
<td>12189</td>
</tr>
</tbody>
</table>
## APPENDIX 2. TYPOLOGY OF TOOLS

| Tools for specific hazards | RIBASIM - Modelling the hazard - (for river basins under varying hydrological circumstances)  
MIKE BASIN: spatial tool, Surface- and groundwater system modelled, water quality descriptions – also **Aquarius**  
European Flood Alert System (EFAS) - flood forecasting products.  
Water Evaluation and Planning System (WEAP) that look at the complex relationships between the numerous factors affecting water and food security. Demand scenarios associated with various policy options.  
DINAS-COAST coastal resources model includes natural system and socioeconomic factors, outputs impacts, trade-offs of adaptation costs, id of vulnerable areas in a graphical-user interface; also SIMCLIM simulates, temporally and spatially, bio-physical impacts and socio-economic effects of climatic variations, including extreme climatic events  
Rapid analysis of coastal hazard vulnerability- SMARTLINE |  
---|---

**Methodology tools for climate risk assessment:**  
To assist in decision-making- decision support:  
Comprehensive Hazard and Risk Management (CHARM) - all hazards (includes climate change impacts) risk management step by step process fitted within the context of national sustainable development policies. From south pacific. Based on New Zealand Risk Management Standard.  
Climate Related Risks Estimate as Indicators of Necessity for Adaptation Responses  
(1) to estimate probability of dangerous weather event or climate anomaly on the given territory;
(2) to evaluate social damage as correlation between people's number in the endangered region and damage probability; "fuzzy set" method could be used for complex risk estimation;

(3) To calculate damage expressed in relative or monetary units taking into account GDP.

UKCIP assists in generating data for climate change strategy includes: a record of the users' vulnerability to current climatic variability; a prioritized list of climate risks; a list of possible adaptation measures to address those risks; adaptation options appraisal; and an implementation strategy. CAT (Climate Adaptation Tool (CAT) is also similar uses MCA and scoring.

UNDP Quality Standards for the Integration of Adaptation to Climate Change into Development Programming. UNDP Adaptation Policy Framework (APF) - provides an interface between scientists, academics, and policy makers. At the heart of the process are scenario writing, scenario analyses via the interactive formulation and testing of alternative policies that respond to challenges in the scenario.

Multi-criteria analysis - allows decision makers to include a full range of social, environmental, technical, economic, and financial criteria to judge between adaptation options.

Uncertainty and Risk Analysis allows for the introduction of uncertainty into the risk analysis, which is very useful. It is used in addition with the risk assessment method.

Livelihood sensitivity exercise - for integrating existing knowledge of climate vulnerability with livelihood analysis

Global Sustainability Scenarios - provide global scenarios that integrate adaptation issues which assist in putting local development into a context. Requires extensive data inputs.
| Community based method | Cristal- Community-based Risk Screening Tool – Adaptation and Livelihoods  
Looks at consideration of climate change adaptation in community development projects from a livelihoods perspective.  
Community Vulnerability Assessment Tool (CVAT) - uses static GIS maps. Hazard Identification; Critical Facilities, Societal, Economic, and Environmental Vulnerability; and Mitigation Opportunities |
|---|---|
| Risk Screening Tool | CCORAL- government  
UNDP Quality Standards for the Integration of Adaptation to Climate Change into Development Programming, UNDP Adaptation Policy Framework (APF)  
Climate change and Environmental Degradation Risk and Adaptation assessment (CEDRA) by Tearfund- Climate change and disaster risk screening for projects/ project locations in developing countries inform decision-making to adapt some projects, stop doing some projects or start new ones. |
| Quantitative models | Cost- benefit analysis- conceptual framework for analysing an adaptation measures |
| Economic models | Resource Approach to Assessment of Climate Change Impact on Human Activity allows decision makers to include information on climate conditions and their change directly in economic analysis. |
| Integrated systems models | These combine dynamic simulation with expert judgment. |
| Impact Matrix approach |  |
| Expert and stakeholder judgment | Rapid assessment of the state of knowledge about a particular aspect of climate change. Usually an element of a greater decision-making process. Facilitates aggregation of opinions, |
| Adaptation Evaluation | The South Pacific Island Methodology (SPIM) which is an index based method where scores are assigned based one expert knowledge to judge adaptation options in a variety of scenarios. |
| Remote sensing and GIS | Assesses various shoreline management plans to coastal erosion and flooding Shoreline Management Planning (SMP)  
| | Screening of Adaptation Options, simple matrix- not spatial |
| **Sectoral Models** | Agriculture- Relative Risk Index (RRI) for farmers based on decisions and climatic variations  
| | Local Climate Estimator (New_LocClim) - Agroclimatic maps for areas also that do not have data.  
| | Specific crop models that simulate growth and yield based on climate inter alia e.g. GLYSIM, Erosion Productivity Impact Calculator (EPIC)  
| | Socio-economic damage assessment guidelines-ECLAC handbook |
| **General** | Agent based models that seek elicit knowledge on how people may behave in various climate change scenarios.  
| | Stakeholder Networks and Institutions provide important understanding of who make the decisions and how they relate to one another. |
| **Vulnerability Indices** | Assist in targeting particular regions. This research focuses on one SID. The index would consist of indicators in general though it is recognised that substantial methodological challenges remain — in particular estimating the risk of adverse climate change impacts and interpreting relative vulnerability across diverse situation. |
## APPENDIX 3. PARTICIPANTS BY CATEGORY WITH JOB ROLES

<table>
<thead>
<tr>
<th>Level</th>
<th>Organisations</th>
<th>Job Role</th>
<th>Type of organisation</th>
<th>Data Gathering Method $^{10}$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Very High Level Decision Maker</strong></td>
<td>Ministry of Home Affairs</td>
<td>Permanent Secretary and Deputy Permanent Secretary Minister</td>
<td>Government</td>
<td>I</td>
</tr>
<tr>
<td></td>
<td>Barbados Association of Professional Engineers</td>
<td>(Management) Agency Director</td>
<td>Private</td>
<td>EQ</td>
</tr>
<tr>
<td></td>
<td>Barbados Investment and Development Corporation</td>
<td>(Management) Human Resources</td>
<td>Government</td>
<td>EQ</td>
</tr>
<tr>
<td></td>
<td>Barbados Light and Power</td>
<td>(Management) Engineering/ Customer Service</td>
<td>Private</td>
<td>EQ</td>
</tr>
<tr>
<td></td>
<td>Barbados Meteorological Services</td>
<td>(Management) Administration</td>
<td>Government</td>
<td>EQ</td>
</tr>
<tr>
<td></td>
<td>Barbados Statistical Service</td>
<td>Management (Head of Agency)</td>
<td>Government</td>
<td>EQ</td>
</tr>
<tr>
<td></td>
<td>Coastal Zone Management Unit</td>
<td>Deputy Head of Organisation</td>
<td>Government</td>
<td>I, PO</td>
</tr>
<tr>
<td></td>
<td>Department of Emergency Management</td>
<td>Head of Organisation</td>
<td>Government</td>
<td>I, PO</td>
</tr>
<tr>
<td></td>
<td>Drainage Division</td>
<td>Head of Organisation</td>
<td>Government</td>
<td>I</td>
</tr>
<tr>
<td></td>
<td>Environmental Protection Department</td>
<td>Management</td>
<td>Government</td>
<td>EQ</td>
</tr>
<tr>
<td></td>
<td>Future Centre Trust</td>
<td>Management (Head of Organisation)</td>
<td>NGO</td>
<td>EQ</td>
</tr>
<tr>
<td></td>
<td>Town and Country Development Planning Office</td>
<td>Head of Organisation and Deputy Head of Organisation</td>
<td>Government</td>
<td>I</td>
</tr>
<tr>
<td></td>
<td>Ministry of Tourism</td>
<td>Management</td>
<td>Government</td>
<td>EQ</td>
</tr>
<tr>
<td><strong>Technocrat</strong></td>
<td>Barbados National Standards Institute</td>
<td>Technical (Specifications Development)</td>
<td>Government</td>
<td>EQ</td>
</tr>
<tr>
<td></td>
<td>Barbados Water Authority</td>
<td>Technical (Water Quality)</td>
<td>Government</td>
<td>EQ</td>
</tr>
<tr>
<td></td>
<td>Caribbean Disaster Emergency</td>
<td>Project Manager</td>
<td>Intergovernmental</td>
<td>EQ</td>
</tr>
</tbody>
</table>

$^{10}$ EQ= Electronic Questionnaire; I= Interview; PO= Participant Observation
<table>
<thead>
<tr>
<th>Level</th>
<th>Organisations</th>
<th>Job Role</th>
<th>Type of organisation</th>
<th>Data Gathering Method</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Management Agency (Coordinating Unit)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Caribbean Institute for Meteorology And Hydrology</td>
<td>Chief Hydrologist, Climatologist, Technical Officer</td>
<td>Intergovernmental, Academic</td>
<td>I</td>
</tr>
<tr>
<td></td>
<td>University of the West Indies: Centre for Resource Management and Environmental Studies; Department of Computer Science, Mathematics and Physics</td>
<td>Director, Senior Lecturer (Technical), Lecturer</td>
<td>Private, Academic</td>
<td>EQ, I</td>
</tr>
<tr>
<td></td>
<td>Coastal Zone Management Unit</td>
<td>Information Systems Manager</td>
<td>Government</td>
<td>I, PO</td>
</tr>
<tr>
<td></td>
<td>Department of Emergency Management</td>
<td>Programme Officer</td>
<td>Government</td>
<td>I, PO</td>
</tr>
<tr>
<td></td>
<td>Senior Technical Officer</td>
<td>Senior Technical Officer</td>
<td>Government</td>
<td>I</td>
</tr>
<tr>
<td></td>
<td>Lands and Surveys Department</td>
<td>Technical</td>
<td>Government</td>
<td>EQ</td>
</tr>
<tr>
<td></td>
<td>Ministry of Health, Environmental Health Department</td>
<td>Technical</td>
<td>Government</td>
<td>EQ</td>
</tr>
<tr>
<td></td>
<td>Ministry of Social Care, Constituency Empowerment and Community Development</td>
<td>Technical</td>
<td>Government</td>
<td>EQ</td>
</tr>
<tr>
<td></td>
<td>Town and Country Development Planning Office</td>
<td>Planning Assistant</td>
<td>Government</td>
<td>I</td>
</tr>
<tr>
<td></td>
<td>Ministry of the Environment</td>
<td>Project Manager</td>
<td>Government</td>
<td>I</td>
</tr>
</tbody>
</table>
Student ID: 9128232

Sent by email to: Nicole.greenidge@postgrad.manchester.ac.uk
PhD Human Geography

15 December 2014

Dear Nicole

School Ethics Advisory Group (SEAG) – November 2014

Title:  “An Integrated National Disaster Risk Reduction and Climate Change Adaptation Development Investment Framework for Barbados- A Small Island Developing State (SIDS)”

I write to confirm that the Chair is now satisfied that you have addressed the concerns of the SEAG. The SEAG has therefore given the research project a favourable ethical approval using the pre-approved University Research Ethics Committee (UREC) template.

It is the Advisory Group’s practice to inform investigators that they should not deviate from the agreed protocol without seeking further approval from SEAG.

If anything untoward happens during your research, then please make your supervisor aware. They can then raise any issues with SEAG on your behalf.

Best wishes during the research.

Regards,

Dr David Lawson
Senior Lecturer Development Economics and Public Policy

Cc  Dr Sarah Lindley
    Student file
APPENDIX 5. PARTICIPANT INFORMATION SHEET

PhD Research study on

An Integrated National Disaster Risk Reduction and Climate Change Adaptation Development Investment Framework for Barbados- A Small Island Developing State (SIDS)

I would like to invite you to take part in a research study on developing an integrated national disaster risk reduction and climate change adaptation development investment framework for Barbados. The development framework looks at using spatial methodologies to facilitate integration between decision-making processes related to Disaster Risk Reduction and Climate Change Adaptation (DRR-CCA) in the context of a Small Island Developing State like Barbados. This is a PhD research project and I am interested in your views.

I would like you to understand why the research is being done and how you will be involved.

If you are interested in participating, please feel free to contact me to discuss it further (details on last page).

What is the purpose of the study?

We don't know much about how spatial methodologies could be used to facilitate integrated Disaster Risk Reduction and Climate Change Adaptation (DRR-CCA) governance in the context of Small Island Developing States like Barbados. We also don't know what a working framework looks like to support this kind of methodology in SIDS. I would like to interview you to get a better understanding of what the current processes are and how they could be made better using these kinds of technologies.

Why have I been invited to take part?

You have been invited because you are a stakeholder in the process of making decisions
concerning what to do about the risk facing Barbados from climate related hazards. You may therefore be in a position to offer practical insight into how this could become a working process. This interview will talk about the current decision-making processes that are being used in Barbados to manage the potential impacts (risks) on the country’s prosperity and development from climate related hazards like floods and droughts. It also looks at the processes for managing risks from climate change. We will also talk about ways to improve the process. The objective is to improve the day-to-day decision-making processes and to develop a new framework that can reduce losses and support development.

**Do I have to take part?**

No, it is up to you to decide whether or not to join the study.

**What is required of me if I do take part?**

Subject to your consent I hope to conduct one interview with you. I anticipate these will be between 45 -60 minutes. The interview will be done in a private space in your office environment at a time that is suitable to you. I would like to audio record the interview so I can transcribe later.

**What are the possible advantages and disadvantages to taking part?**

You will be helping Barbados improve its knowledge on practical ways to minimize the possible losses from climate change and natural disasters. This is an area of research which is relatively new and we will be adding to the evidence base not only for Barbados but for other Small Island Developing States like Barbados. As a result of your participation a new and better framework for managing climate hazard risks in Barbados will be developed.

**Will my taking part in this study be kept confidential?**

Yes, all information gathered in this study will be kept confidential unless there is a possibility of harm occurring to yourself or others. In the possibility of harm, appropriate authorities will be informed and support will be arranged and offered to you. Because I prefer to audio record the interview, it will be ensured that interview transcripts have identifiable information removed and are carefully stored.
What information will be collected?

The discussion/interview will be digitally recorded for transcription and analysis by the researcher, myself but your name and details will not be used. The notes will only be used by researchers from the University of Manchester, and we aim to publish a paper around the results of these interviews. Direct quotations from your interviews may be used in the write-up of the study and where used, these will be anonymous. No individuals will be able to be identified and your privacy will be protected. The audio files and transcripts will be stored on an encrypted device at the University of Manchester.

How and where will data be stored?

Data will be stored on a secure laptop and on the secure university P drive; any data on portable devices will be password protected.

Who is organising and sponsoring this research?

This is being organised by me and is supervised by staff at The University of Manchester. Dr. Sarah Lindley and Dr. Richard Kingston are the supervisors. This research is funded by the UK Department for International Development through the Commonwealth Scholarship Commission in the United Kingdom (CSC).

Who has reviewed the study?

This study has been reviewed and approved by the University of Manchester School of Education, Environment and Development Ethics committee.

What will happen to the results of the research study?

Full research results will not be ready until two years after your interviews have taken place. I will ask you after the interview if you want a short report. The report will be written in English. If it is appropriate for you, I will contact you when it is ready and send you a copy if you wish to read it. Anonymised quotations may be used in publication.

What if there is a problem?

If you have a concern about any aspect of this study, you should ask to speak to me and I will do my best to answer your questions. If I am unable to resolve your concern, you can
contact my supervisors (sarah.lindley@manchester.ac.uk or +44(0) 275-8685 and richard.kingston@manchester.ac.uk or +44(0)161-275-1936). If you wish to make a complaint regarding the study, please contact the University Research Practice and Governance Coordinator on 0161 2757583 or 0161 2758093 or by email to research-governance@manchester.ac.uk.

What do I do next?

Please let me know if you would like to take part in the study by contacting me.

Further Questions?

If you are interested in taking part but have further questions. Please contact me.

Nicole Greenidge

22 Grazettes Gardens
St. Michael
Barbados
Tel: +246 424-3503
Email: nicole.greenidge@postgrad.manchester.ac.uk
Research study on
An Integrated National Disaster Risk Reduction and Climate Change Adaptation Development Investment Framework for Barbados - A Small Island Developing State (SIDS)

1. I confirm that I have read and understand the information sheet dated _____ (version 1) for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily. I agree to take part in the above study and to inform the researcher if I am no longer comfortable with participating in the study.

2. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason, and that I will not be penalised for withdrawing nor will I be questioned on why I have withdrawn.

3. I give permission for interviews to be transcribed.

4. I give permission for anonymised quotes to be used in any publications. These quotes will remove all my personal details.

5. I understand that other researchers will have access to this data only if they agree to preserve the confidentiality of the data and if they agree to the terms I have specified in this form.

6. The procedures regarding confidentiality have been clearly explained (e.g. use of names, pseudonyms, anonymisation of data, etc.) to me. All data will be kept confidential.

_________________  ___________  ___________________
Name of participant  Date  Signature

_________________  ___________  ___________________
Name of person taking consent  Date  Signature
APPENDIX 7. CONSENT FORM (ORGANISATION)

Research study on
An Integrated National Disaster Risk Reduction and Climate Change Adaptation Development Investment Framework for Barbados- A Small Island Developing State (SIDS)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>I have read the Participant Information Sheet (Organisation) and understand the</td>
</tr>
<tr>
<td></td>
<td>nature of the research and why this organisation has been selected. I have had the</td>
</tr>
<tr>
<td></td>
<td>opportunity to ask any questions and have them answered to my satisfaction.</td>
</tr>
<tr>
<td>2.</td>
<td>I understand that participation by this organisation is voluntary. I understand</td>
</tr>
<tr>
<td></td>
<td>that I am free to withdraw the organisations’ input to the study at any time</td>
</tr>
<tr>
<td></td>
<td>without giving a reason.</td>
</tr>
<tr>
<td>3.</td>
<td>I understand that participation by individual members is voluntary and interview</td>
</tr>
<tr>
<td></td>
<td>responses are anonymous.</td>
</tr>
<tr>
<td>4.</td>
<td>I agree to contact members of this organisation on behalf of the researcher and or</td>
</tr>
<tr>
<td></td>
<td>provide the approval for the researcher to ask people whether they would like to</td>
</tr>
<tr>
<td></td>
<td>take part in the research.</td>
</tr>
<tr>
<td>5.</td>
<td>I understand that the organisation may be requested to send reminder emails to</td>
</tr>
<tr>
<td></td>
<td>members on two occasions.</td>
</tr>
<tr>
<td>6.</td>
<td>I understand that the interview will take about 60 minutes. The workshops will</td>
</tr>
<tr>
<td></td>
<td>last ____ days.</td>
</tr>
<tr>
<td>7.</td>
<td>I understand that the data will be securely kept for five years and then destroyed.</td>
</tr>
<tr>
<td>8.</td>
<td>I would/would not like a copy of the summary results.</td>
</tr>
<tr>
<td>9.</td>
<td>I agree for members of this organisation to be invited to participate in the</td>
</tr>
<tr>
<td></td>
<td>interviews and workshops.</td>
</tr>
<tr>
<td>10.</td>
<td>I give permission for my organisation’s name to be used and understand that</td>
</tr>
<tr>
<td></td>
<td>what I have said or written on behalf of the organisation as part of this study</td>
</tr>
<tr>
<td></td>
<td>will be used in reports, publications and other research outputs so that anything</td>
</tr>
<tr>
<td></td>
<td>my organisation has contributed to this project can be recognised. Approval will</td>
</tr>
<tr>
<td></td>
<td>be sought first from the organization before any quote is made public.</td>
</tr>
<tr>
<td>11.</td>
<td>Nicole Greenidge can / cannot (delete one) use facilities within this organisation</td>
</tr>
<tr>
<td></td>
<td>to interview participants. By agreeing to this, I agree that the organisation has</td>
</tr>
<tr>
<td></td>
<td>public liability insurance and is willing to provide a suitable location / room for</td>
</tr>
<tr>
<td></td>
<td>the interview (with suitable &amp; prior notice).</td>
</tr>
<tr>
<td>12.</td>
<td>By signing below, I am indicating that I consent to the above on behalf of the</td>
</tr>
<tr>
<td></td>
<td>organisation and that I am in a position to do so</td>
</tr>
</tbody>
</table>

Name ___________________________ Position ___________________________

Organisation ______________________ Date ___________________________ Signature _________________________
APPENDIX 8.  ELECTRONIC SURVEY

1. Overview- About the Questionnaire, Study and Consent
By clicking "I agree" below you are indicating that you have read and understood the details of the study and agree to provide consent on behalf of your organisation to participate in this research study.

Please tell us the name of your organisation.

2. (untitled)
Thank you for agreeing to complete this questionnaire. You may now proceed to Question 1.

3. Tell us about you and your organisation

Please tell us the name of your department or team (if applicable).
How long have you been working with your organisation?
What is your job category in the organisation?
Management
Technical
Finance
Support Staff
Other, please specify

If your organisation is involved with service provision, which of the following services are relevant? Please select all that apply.

At which level (s) does your organisation carry out its operations? Select all that apply.

4. My organisation's climate and weather related activities
This section looks at the kinds of climate and weather related activities that may concern your organisation.
Your organisation may be concerned with the actual hazard/ threat or the potential impacts which may be social, economic or environmental. Alternatively you may be concerned with generating and communicating information concerning the threat or potential impacts.
If your organisation is working on climate and weather related themes concerning Barbados, which of the following does it include? Select all that apply.
1. Nothing
2. Identifying which climate related risks or potential impacts should be of concern
3. Monitoring and early warning of climate hazards/ threats
4. Analysing the behaviour and strength of climate hazards/ threats
5. Identifying social, economic or physical conditions that may cause susceptibility to climate hazards
6. Assessing perceptions about the climate hazard (s) and potential impacts
7. Understanding/ analysing potential social, economic, physical, or environmental impacts and spill over effects from the climate hazard
8. Addressing potential, economic, physical or environmental impacts from climate hazards.
9. Collecting or providing/ distributing data (social or economic or physical or environmental)
10. Setting out procedures and rules for conducting assessments
11. Making judgments about the levels at which the potential climate hazard and its impacts could be tolerable (do nothing) or accepted with action (take action)
12. Building awareness amongst risk professionals and or the public, or the media about climate hazards and their potential impacts
13. Responding to emergencies
14. Rebuilding and recovery

Other (please state)

5. Let’s talk about importance
On this page we look more at the climate and weather related activities of your organisation as selected at Question 6.
Specific questions are asked about the importance of each of your activities with the exception of recovery and response- which will not be addressed further in this questionnaire.
How much of your organisation's budget (%) is put towards the climate and weather/ related activities as a sum total?
Budget %
How often does your organisation work on these climate and/ weather related themes?
Daily Weekly Monthly Quarterly Semi-annually Annually
Which of the following hazards/ threats does your organisation consider in its climate or weather related activities above? Which of the following best describes why your organisation does work in the climate and/ weather related themes you mentioned?

6. More about hazards of interest!
This page asks more about the hazards considered in your work. Your selection of hazards from the previous page are copied below for your convenience. Please rank the level of consideration or importance given by your organisation to these hazards in its climate and/ weather related work. If climate change or future extreme weather is considered for this hazard (s)/ threat (s), please check the box next to the hazard (s). Please say how this is being done in the comments box. If you are getting assistance from other organisations to make your climate change considerations also state this in the comments box.
Options piped from question 12.

7. Climate Change in my organisation's activities
The climate change/ weather related activities which you selected at question 6 are shown as a reminder. You selected the following:
Options piped from question 8.
How often does your organisation include climate change or future extreme weather considerations when undertaking your climate related activities (see above). Which of the following best describes why climate change or future extreme weather considerations MAY NOT be included in your organisation's climate related activities (your activities from Q. 6 are recorded at the top of the page as a reminder)?

8. Information Close Up
In this section we ask specifically about your role and the kinds of information that your organisation may generate or use when dealing with the climate related activities you selected at Question 6. Information here refers to knowledge and experience. This may be gained from various disciplines and sources. Please tell us more about your organisation's role and the kind of information that you may use and or generate that may be related to climate related hazards and their socio-economic impacts. Your activities as stated at Q.6 are shown in the left column of the table.
Your organisation's specific activity
Information used or collected to carry out the activity
Information generated as a result of the activity

In view of the activities that you mentioned above, what OTHER information (knowledge or experience) does your organisation require to better carry out its climate related work?

9. Sources of Information

Questions on this page ask more about the kinds of information and the sources of information that you use when carrying out your climate related activities.

As a reminder you indicated that your organisation works in the following climate related themes:

Options piped from question 8.

Reflecting on the specific climate related work and the activities you mentioned on the previous page, what determines the kind of information that you use?

Never Rarely Sometimes Often Always

AVAILABILITY- the information is quickly and easily available
USABILITY - the information is in a convenient format and can be easily interpreted
ACCURACY - the information is free from or has limited errors
TIMELY - the information is relevant and current
POLICY GUIDANCE - policies or laws require that the information be included
FUNDING - there are funds available to access or utilise the information
SOURCE - the information is from a trusted authority
CAPACITY - there is expertise to utilise the information
COMPREHENSIVENESS - the information is inclusive and of a large scope

Concerning the kinds of activities you mentioned on the previous page, when carrying out your climate related work how frequently does your organisation use the following sources of information?

Never Rarely Sometimes Often Always

Individual Experience
External stakeholders (individuals or groups)
Informal communication within the organisation
External Consultants
Specialist advisors within the organisation
Media reports/ coverage
Primary data collected by the organisation
Formal reports national
Formal reports regional
12. Information Sharing and Your Organisation

The climate change/ weather related activities which you selected at question 6 are noted here as a reminder. You selected the following:

Options piped from question 8.

Please use the drop down menus to tell us about the MAIN kinds of information that your organisation may share with the GOVERNMENT organisations (A-L) in the list below- when you carry out your climate related activities (see reminder above).

<table>
<thead>
<tr>
<th>What I share</th>
<th>Relationship</th>
<th>How I share</th>
<th>Why I share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barbados Fire Service</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barbados National Standards Institute</td>
<td></td>
<td></td>
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<tr>
<td>Barbados Statistical Service</td>
<td></td>
<td></td>
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<tr>
<td>Barbados Water Authority</td>
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<tr>
<td>Coastal Zone Management Unit</td>
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<tr>
<td>Community Constituency Empowerment</td>
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<td></td>
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<tr>
<td>Community Development Department</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Department of Emergency Management</td>
<td></td>
<td></td>
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<tr>
<td>Drainage Division</td>
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<td></td>
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<tr>
<td>Environmental Protection Department</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Government Information Service</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lands and Surveys</td>
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</tbody>
</table>

Repeating the steps above, please tell us about the information that you may share with the GOVERNMENT organisations (M-W) in the list below please select the best answers from the drop down menu

<table>
<thead>
<tr>
<th>What I share</th>
<th>Relationship</th>
<th>How I share</th>
<th>Why I share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meteorological Services</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Ministry of the Environment</td>
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<td></td>
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<tr>
<td>Ministry of Finance &amp; Economic Affairs</td>
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<tr>
<td>Ministry of Health</td>
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<tr>
<td>Ministry of Tourism</td>
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<tr>
<td>Ministry of Transport &amp; Works</td>
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<tr>
<td>Minister</td>
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<td></td>
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<tr>
<td>Soil Conservation Unit</td>
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<tr>
<td>Town &amp; Country (TCDP)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Welfare Department</td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>
If there are other government organisations that have not been included in the matrix with whom you share information with when carrying out your climate related activities, please tell us below.

What I share/ How I share/ Why I share

13. Information Sharing and Your Organisation- NGOs

In this section we continue from the last section by asking about the Non-Governmental Organisations (NGOs) that your organisation may share information with or that you may collaborate with when carrying out your climate related activities for Barbados. Recall that: ‘Sharing information’ means the use or provision of information (including data, case studies, ideas, best practice, resources etc., whether through verbal communication, online or documents/reports).

By ‘collaboration’ we mean going further than just sharing existing information, e.g. generating new information, working together (on a formal or semi-formal basis) on projects, developing joint initiatives, plans, policies or procedures.

The climate change/ weather related activities which you selected at question 6 are noted here as a reminder. You selected the following:

Options piped from question 8.

Please use the drop down menus to tell us about the MAIN kinds of information that your organisation may share with the NON-GOVERNMENTAL organisations (A-G) in the table below when you carry out your climate related activities (see reminder above).

What I share
Relationship How I Share
Why I share
Barbados Association of Professional Engineers
Barbados Chamber of Commerce
General Insurance Association of Barbados
Barbados Investment
Barbados Light and Power
Barbados Red Cross
Future Centre Trust
University of the West Indies, CERMES
Caribbean Institute for Meteorology and Hydrology
Community Groups
Caribbean Disaster Emergency Management Agency (CDEMA)
If there are other Non-Governmental Organisations, that have not been included in the matrix, with whom you share information with when carrying out your climate related work, please tell us below.

What I share/ How I share/ Why I share

15. The big picture!

How would you describe the process for managing potential losses or risks from climate related hazards in Barbados? Please read each statement carefully and select the extent to which you agree or disagree with each of the following.

1. 'There is a clear system for making decisions about how to manage potential losses from climate related threats'
2. 'There is a clear goal for the process of managing potential losses from climate related hazards'
3. 'It is clear how stakeholders are selected, and how views are incorporated in the process for managing climate related risks'
4. 'There are clear communication procedures, and methods for reaching agreement'
5. 'There is competent understanding of the risk/ potential loss issue (s) and there is competency in using purposeful reasoning'
6. 'There is adequate representation in the participatory process and equal opportunity for input'
7. 'There is a balanced proportion of resources dedicated to participate in the process'
8. 'There is a clear mandate of what is expected from my organisation in the process of participation'
9. 'Multiple perspectives and disciplines are incorporated in the process'
10. 'The process is structured, moderated and facilitated professionally'
11. 'It is clear how my organisation’s work fits in with this process'

17. Other Themes

What may be some of the climate related themes that you are not now working on that may be relevant to your organisation?

Options piped from question 8.

18. Thank you for your time!

I wish to be contacted by the researcher regarding alternative participation (for example interviews or workshops) in this study?
Please fill out the following contact form to participate further in this study.

First Name
Last Name
Title
Organisation Name
Address Line 1:
Address Line 2:
Parish
Email Address
Phone Number
I would like to be contacted about:

22. Thank You!

Thank you again for taking our questionnaire. Your responses are very important.
APPENDIX 9. INTERVIEW PROTOCOL - HEAD OF DEPARTMENT/ AGENCY

- Rapport established. Background to the researcher provided, and also on interviewee role in organisation, position and duties (where unknown)

- Introduction to the study - overview, purpose.

- Introduction to the interview - topics to be covered as per the information document provided, plans for use of the information. Queries addressed. Confidentiality explained and anonymity and consent discussed and agreed and provided.

1. Context

1.1. What is your organisation’s role in managing climate-related risks? Please explain.

1.2. Which climate related hazards/risks are you concerned with? Are you concerned with climate change related hazards/risks?

1.3. What are the ways that your role contributes to making decisions about how risks should be managed in Barbados?

1.4. How does it contribute to meeting the sustainable development goals for Barbados?

2. What is driving the kinds of actions taken to manage these climate related risks?

2.1. How does the current process to manage risks lead to sustainable development?

2.2. How do you think current frameworks can be adjusted to meet the intensified challenges from climate change?

3. Process - General Information and Tools

I would like to learn about the key processes involved in carrying out your role. Information (Information here refers to knowledge and experience from various disciplines and various sources including uncertainty information and articulations of risk perceptions and values, issues (such as reversibility, persistence, ubiquity, tolerability, equity, catastrophic potential,
controllability, voluntariness synthesized or integrated in the risk assessment and evaluation) and Networks

3.1. What guides you in determining the kinds of information needed?

3.2. What kind of data/information is used in this process?

3.3. How do you use spatial information like GIS, maps, documents, policies, advice, e.g. risk estimates, uncertainty measures, hazard characteristics, range of interpretations, risk perceptions, social and economic implications (sustainable development implications). Is it the same for climate change?

3.4. How do you access the information needed to carry out your role? Is it the same for climate change?

3.5. How do you use the information needed to carry out your role? Is it the same for climate change?

3.6. How do you view the quality of the data/information that you are accessing? Is it the same (response) for climate change?

3.7. How does this impact on the decision-making process? How do you account for uncertainty in the information?

3.8. How could the information process be improved?

4. Frameworks, tools & Spatial processes

4.1. Is there an overarching governance framework that is used?

4.2. Can you tell me about what tools you may use to carry out this process?

4.3. What are the frameworks and or rules that you may use to carry out this process?

4.4. How do you view the potential for use of spatial tools to improve this process? What are the opportunities and challenges?

5. Social Dynamics and Institutions

5.1. What would you say drives this process in your organisation? Please tell me more.
6. Stakeholder interactions, sharing, roles and rules

6.1. How do you work with other organisations or entities to perform this role?

6.2. How does this impact the effectiveness of the process?

6.3. How are roles defined and realised? (Community, Private sector, Scientists, Specific agencies, laws?)

6.4. Are there other stakeholders in the process that you recommend for inclusion?

6.5. Please use the below matrix to provide details on the kinds of interactions you may have with stakeholders.

7. Integration, coordination and improvement

7.1. How would you improve your role in the risk management process?

7.2. How do you think opportunities for coordinating resource, allocation, and implementation can be realised in view of climate change related threats?

7.3. Do you see a role for an integrated approach to improving the framework for managing present extremes and future climate change related extremes?

7.4. What do you think will be necessary to support this integrated approach?

7.5. How do you think spatial tools could be used to improve this process?

Ending

The researcher will thank the participant and ask whether there was anything further they wanted to add. The researcher will ask if the participant would like a short copy of the report when it is ready and if it is safe to send it by post or email. The researcher will ask for permission to interview technical staff and to observe the process where applicable to have further details on the process.
Introduction

The researcher will establish rapport, give a background to the researcher, explain the purpose of the study, explain what will happen with the information. During this time, assurance of confidentiality and anonymity will be given. Participant will be informed of the duration of the interview, and permission will be sought to record the interview. The researcher will provide the opportunity to ask questions, listen and respond to any concerns before asking to obtain informed consent. Depending on the role identified by the Head of Agency, the list of questions from roles A-D are asked.

A. Pre assessment: (How is risk information framed, collected, screened?)

i. How do you determine the climate related threats that should be monitored or treated by Barbados?
   a. What are the conventions?
   b. What are the procedures?
   c. What are the tools used?
   d. How are spatial tools utilised in this process?
   e. If not what are the opportunities for their use?

ii. How is this done for emerging climate related threats induced by climate change?
   a. What are the conventions?
   b. What are the procedures?
   c. How are spatial tools utilised in this process?
   d. How are spatial tools utilised in this process?
   e. If not what are the opportunities for their use

iii. How are other entities engaged in this process?
iv. How do you establish the procedures for determining the assessment and management routes for hazards and risks includes criteria for identifying and measuring social concern?

v. Are they any issues that weigh in related to the smallness of the country?

vi. How do the outputs of the process support the sustainable development process of Barbados?

vii. How is this process communicated to stakeholders internal to the system and to the outside world?
B. **Risk evaluation:** (How are hazards (specific hazard is identified here based on response from ‘Head’ at 1a) evaluated and social concern incorporated)

**Hazard Assessment, Exposure, Vulnerability and Risk Assessment**

i. What tools, rules and information do you use to undertake the hazard assessment?
   a. hazard estimation,
   b. exposure assessment,
   c. vulnerability assessment,
   d. risk assessment?

ii. What is the scale of the information? How do you collect this information and synthesize it?

iii. How are other entities engaged in this process?

iv. Is this process spatial?

v. What of the process for incorporating this information is included in the decision-making process? How could it be improved?

vi. How is this process communicated to stakeholders internal to the system and to the outside world?

**Social Concern Assessment**

i. How do you incorporate social concerns into the evaluations of this risk? For example things like risk perceptions, socioeconomic impacts, values, beliefs, world views?

ii. What tools, rules and information do you use to undertake the social concern assessment?
   a. Assessing perceptions: familiarity and experience; understanding concerning the nature of the hazard; repercussions of risk, perceptions of fear and dread;
perceptions of personal or institutional control; degree of trust in risk management organisations

b. Potential for social conflict and mobilisation
c. Spill over effects for example into financial markets and or loss of credibility
d. Calculating the social and economic implications of risk

iii. What is the scale and sources of the information? How do you collect this information and synthesize it?

iv. How are other entities engaged in this process?

v. Is this process spatial?

vi. How would you improve the way in which these concerns are incorporated in the policy formulating/assessment process?

vii. How is this process communicated to stakeholders internal to the system and to the outside world?

C. Risk Judgement (Determination of the ‘acceptability’ or ‘tolerability’ of a given risk).

i. What tools, rules and information are used to collect and summarise the evidence needed? What is the format of this information?

   a. For example what would be involved in the decision about the flood acceptability levels in Barbados?

   b. How is the level of risk acceptance determined?

   c. What are the decision-making tools or the technology that is used?

   d. How do you come to make suggestions concerning the potential options for handling the risk?

   e. How do you utilise any of the outputs of the risk assessment studies?
f. What facilitates the uptake of this information as opposed to others?

g. What is the quality of this information/ scale, accuracy, up to date?

h. How do you handle uncertainty in the information?

ii. How are sustainable development implications considered in the process?

iii. How do you consider trade-offs?

iv. How are the scenarios of options considered? What is the opportunity for using a spatial tool?

v. How do you make judgments on the severity of the risk?

vi. What informs this process?

vii. How do you determine the need for risk reduction measures? How do you apply societal values and norms to the judgement?

viii. What is the process for incorporating these recommendations in the decision-making process?

ix. How is this process communicated to stakeholders internal to the system and to the outside world?
D. Risk Management

i. What tools, rules and information are used to generate options for handling the risk?

ii. How do other steps of risk governance feed into this process?

iii. How do you investigate the impacts of each option whether economic, technical, social or political?

iv. How do you assign trade-offs/evaluate options, incorporate stakeholders and the public?

v. How do you undertake implementation of the (preferred option)?
   a. What drives the implementation of the option?

vi. What are the scales at which these assessments are done?

vii. How is monitoring and feedback on the effects of implementation evaluated?

viii. What is needed to improve this process?

ix. How could spatial tools be used to improve this process?

x. How do the outcomes of this process feed into the other activities to manage risk?

xi. How is this process communicated to stakeholders internal to the process and to the outside world?
APPENDIX 11. INTERVIEW GUIDE (MINISTER/ HIGH LEVEL DECISION MAKER)

(40 min)

PhD Research study on

An Integrated National Disaster Risk Reduction and Climate Change Adaptation Development Investment Framework for Barbados- A Small Island Developing State (SIDS)

These questions are guides only and will serve as general guideline for the interview.

Introduction

The researcher will establish rapport, give a background to the researcher, explain the purpose of the study, explain what will happen with the information. During this time, assurance of confidentiality and anonymity will be given. Participant will be informed of the duration of the interview, and permission will be sought to record the interview. The researcher will provide the opportunity to ask questions, listen and respond to any concerns before asking to obtain informed consent.

Context

1. As a Minister there are critical decisions that you make. What would you say is your role concerning managing possible risks from natural hazards?
   a. Does this role extend to managing risks for natural disasters from climate change?
   b. Is there a strategic decision to leave certain decisions to certain entities?
   c. Which of these decisions would fall under your portfolio?
      i. Purchasing CCRIF insurance against storm damage
      ii. Protecting coastal areas from flooding
      iii. Protecting housing from flooding
      iv. Incentives for complying with a national building code
v. Preventing development in high risk areas

2. What drives the management (the kinds of actions taken and effectiveness) of the possible risk from these threats (natural hazards)?

   a. Does the current risk governance process lead to sustainable development?
   
   b. What can be done in driving this management process to help meet sustainable development goals?
   
   c. How do you think current frameworks can be adjusted to meet the intensified challenges from climate change?

3. What is the bottom line for carrying forward any action on addressing risks from natural hazards?

   a. What is the bottom line for carrying forward any action on addressing risks intensified challenges from climate change?
   
   b. How important is having the public and the government properly informed of the risk that they are exposed to?

Integration

4. How do you view the current approaches being applied to manage the potential for impacts from climate related hazards?

5. A recent IDB (2008) indicates that the risk policies are incipient and that Barbados is unable to finance its risk.

   a. How does this impact your views about the current approaches for managing risks in Barbados?
   
   b. What would be important to make risk policies more effective to deal with present realities/ climate hazards?
c. What will be necessary to address potential losses to livelihoods etc. from climate change related impacts on these hazards?

6. Do you see any role for an integrated approach to improving the framework for managing present extremes and future climate change related extremes?

Process

7. Recently in the news heavy rainfall resulted in significant flooding in the north of the island and in 2010 Tomas resulted in significant damages to homes and infrastructure.

   a. What would you do to improve the processes for managing these kinds of risks?

8. Natural hazards can affect various aspects of the society- road infrastructure, housing, agriculture, tourism.

   b. How do you view the role of a common/ integrated governance framework in improving the management of the risks from these hazards- be they social, economic or physical damages?

   c. What would be important for the framework to be fully functional?

   d. How would you improve the way in which social concerns are incorporated in the policy formulating/ assessment process?

9. I would like to find out more about the processes that you may follow to make decisions concerning managing risks. (Based on the response at 1 b the appropriate scenario from Appendix A is chosen.

   Insert scenario here (For example A- Insurance: Barbados has purchased CCRIF insurance for coverage of possible damages from storm and recently increased its coverage.)

   i. What kind of decision process would have been followed to take this action?
ii. What kind of information informed this decision? Where does it come from?

iii. How do you deal with challenges in data quality and uncertainty?

iv. How important is having information on risk levels in this process?

v. How are social concerns included in this process?

vi. How do you decide on what information is important to inform the decision?

vii. What kinds of rules are used?

viii. What kinds of tools are used?

ix. Are spatial tools like GIS and maps used?

x. What are your views on the use of spatial tools in the decision-making process?

xi. Who participates in this process? Which institutions?

xii. Are they pre-established thresholds and procedures?

xiii. What would you say are the main decisions making factors?

xiv. What would you say are the main inhibiting factors for making the best decision?

xv. What do you think would be useful to improve the processes for decision-making concerning these kinds of threats?

xvi. What changes in this decision-making process to address the impacts from climate change on hazards like flooding from sea level rise, storms and drought?

xvii. What do you think would be useful to improve the processes for incorporating climate change impacts on hazards in this decision-making process?

Probing questions:

Tell me more'----exactly how? could you clarify? Could you explain more? Your meaning of?
Ending

The researcher will thank the participant and ask whether there was anything further they wanted to add. The researcher will ask if the participant would like a short copy of the report when it is ready and if it is safe to send it by post or email.
Appendix A - Scenarios

Road Protection, Housing and Coastal Flooding

A. From time to time flooding like what occurred in the North recently is reported and not too long ago flooding of the road artery in Mullins.

   a. What kind of decision process would you follow to address this problem?
   b. What kind of information informed this decision?
   c. How do you decide on what information is important to inform the decision?
   d. What kinds of rules are used?
   e. What kinds of tools are used?
   f. Are spatial tools like GIS and maps used?
   g. Who participates in this process?
   h. Are they pre-established thresholds?
   i. What would you say are the main decisions making factors?
   j. What would you say are the main inhibiting factors for making the best decision?
   k. What do you think would be useful to improve the processes for decision-making concerning these kinds of threats?

Building code

B. Tomas in 2010 resulted in significant damages to the housing stock in Barbados, revealing the vulnerability in this sector to storm winds. What would be entailed in making the decision to minimise these damages? How would a decision for enforcement of the building code be reached?

   a. What kind of decision process would you follow to address this problem?
   b. What kind of information informed this decision?
   c. How do you decide on what information is important to inform the decision?
d. What kinds of rules are used?

e. What kinds of tools are used?

f. Are spatial tools like GIS and maps used?

g. Who participates in this process?

h. Are they pre-established thresholds?

i. What would you say are the main decisions making factors?

j. What would you say are the main inhibiting factors for making the best decision?

k. What do you think would be useful to improve the processes for decision-making concerning these kinds of threats?
## APPENDIX 12. SELECTED DRR GOVERNANCE LEGISLATION AND APPLICABLE RISK GOVERNANCE FUNCTIONS

<table>
<thead>
<tr>
<th>Legislation</th>
<th>Sector</th>
<th>Purpose</th>
<th>Organisation Responsible</th>
<th>Applicable Risk Governance Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Barbados Growth and Development Strategy 2013-2020</td>
<td>All</td>
<td>To provide a holistic and systematic method to achieve adjustment, reform, recovery and sustainability in the Barbadian economy, through “New Development Pathways”.</td>
<td>Economic Affairs Division Ministry of Finance and Economic Affairs</td>
<td>Management</td>
</tr>
</tbody>
</table>

1. * building climate change resilience; * highlights a number of adaptation/disaster risk reduction measures. For example key measures include the development of a holistic approach that tackles interlinked vulnerabilities rather than each one in turn; updating building codes and retrofitting unsafe buildings; devising a regional framework for common norms on social protection;

---

11 These are called applicable functions because the legislation may not explicitly state a relation to climate related risk governance but the legislation which is within the context of development addresses risk governance activities in general.
<table>
<thead>
<tr>
<th>Legislation</th>
<th>Sector</th>
<th>Purpose</th>
<th>Organisation Responsible</th>
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<td><strong>supporting the poor and disadvantaged,</strong> who have fewer resources or buffers against climate change and other shocks. (Section 5.4.8 of the strategy provides a full list of actions).</td>
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<td>2. Emergency Management Act, Cap. 160A</td>
<td>Disaster management</td>
<td>To provide for the effective organization and management of disasters and other emergencies in Barbados. • investigations, studies • risk assessments • information exchange • national GIS database of vulnerable people and facilities • delineation of vulnerable areas, infrastructure and • community risk reduction programmes • input to environmental or hazard impact assessment • public consideration of</td>
<td>Department of Emergency Management</td>
<td>Risk estimation, communication, management</td>
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<tr>
<td>Legislation</td>
<td>Sector</td>
<td>Purpose</td>
<td>Organisation Responsible</td>
<td>Applicable Risk Governance Function</td>
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|             |        | vulnerable areas.  
• public information and education  
• hazard inspectors | Town and Country Development Planning | Evaluation (Judgment), Management ‘Interdisciplinary estimation’ (indirectly) |
| 3. Town and Country Planning Act, Cap 240 | Physical planning | To make provision for the orderly and progressive development of land in both urban and rural areas and to preserve and improve the amenities thereof, for the grant of permission to develop land and for other powers of control over the use of land, to confer additional powers in respect of the acquisition and development of land for planning, and for purposes connected with the matters aforesaid.  
*Development within provisions of the development plan and any other material considerations, EIAs, Preservation of natural sites, archaeological, historical interest, preservation or protection of forests, woods, trees, shrubs,* | | |
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<th>Legislation</th>
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<th>Organisation Responsible</th>
<th>Applicable Risk Governance Function</th>
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<td><em>plants and flowers, preservation of water protection, restricted development in caves—for example Harrison’s cave and Archcot, airport restriction zone. Development described as any building, engineering, mining or other operations in on or under any land the making of any material change in the use of any building, or other land of the subdivision of land</em></td>
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<td>4. Barbados Physical Development Plan</td>
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<td>Plan, develop and manage settlement and land use systems in a manner which takes into account risks of natural and man-made disasters and coastal erosion. Development control that prevents increased storm runoff and to minimize threats to life and property from potential erosion. Protection of property from hazards (e.g. inland and coastal flooding) includes</td>
<td>Town and Country Development Planning</td>
<td>Risk estimation, Management</td>
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<td>Legislation</td>
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<td><em>setbacks, flood proofing measures, storm water management. Protection of beaches through set-backs. Restricted development in hazard areas - erosion and soil slippage areas. Policy enforcement for integrated coastal management. EIAs that address storm water management.</em></td>
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<td>5. Health Services Act, Cap 44</td>
<td>Health</td>
<td>Relating to the promotion and preservation of the health of the inhabitants of Barbados. the prevention, treatment, limitation and suppression of disease, including the conduct of investigations and enquiries in respect thereof; (b) the publishing of reports, information and advice concerning public health, including advice to the Government and the education of the public</td>
<td>Ministry of Health</td>
<td>Communication Management Estimation (not clear how climate hazards are treated)</td>
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<td>Legislation</td>
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<td>6. Soil Conservation (Scotland District) Act, Cap 396</td>
<td>Agriculture</td>
<td>To make provision for the improvement and conservation of the soil and for the prevention of damage or deterioration by erosion to land in certain areas of Barbados and for matters connected therewith. Measures for improvement, conservation of soil, prevention and mitigation of soil erosion. Including storm water control</td>
<td>Ministry of Agriculture (Soil Conservation Unit)</td>
<td>Management</td>
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<td>7. Prevention of Floods Act, Cap. 235</td>
<td>Planning</td>
<td>To make provision for the execution of works necessary to prevent and control flooding and inundations caused by excessive rains and by high tides and by reason of the low level of various places, causing inconvenience to persons and injury to health and property and to authorise the Minister to take all reasonable steps in</td>
<td>Ministry of Transport and Works (Drainage Division)</td>
<td>Hazard identification and estimation, Management, Communication</td>
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<td>Legislation</td>
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<td>connection therewith’. Flood area delineation. Execution of flood works, notice of persons, premises, crops affected by flood works, Owner or occupier of land to pay for flood works. Buildings and crops prohibited in flood area without permission.</td>
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<td>8. Coastal Zone Management Act, Cap 394</td>
<td>Environment</td>
<td>To provide for the more effective management of the coastal resources of Barbados, for the conservation and enhancement of those resources and for matters related thereto. Research, standards, assessments, preservation, conservation, enhancement, EIAs</td>
<td>Coastal Zone Management Unit</td>
<td>All</td>
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<td>9. Barbados Water Authority Act (1980)-</td>
<td>Water</td>
<td>Outlines the establishment of the Barbados Water Authority and the functions of the Authority as it relates to water supply and analysis. Research, water resource</td>
<td>Barbados Water Authority</td>
<td>All</td>
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| Legislation | Sector | Purpose | Organisation Responsible | Applicable
Risk Governance Function |
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<td>development, conservation, protection</td>
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APPENDIX 13.  CODE THEMES, DESCRIPTION, CATEGORIES AND NOTES FOR FLOOD COMPLAINTS GIS

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<tr>
<th>Theme</th>
<th>Description</th>
<th>Categories</th>
<th>Notes on categories</th>
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| A. Affected | This looks at what or who is exposed to the drainage problem as reported by the caller. It is important to differentiate the problem because from a risk reduction perspective this can indicate the various stakeholders that should be involved in decisions on how to reduce the risks from flooding. Five categories are suggested. | 1. Home  
2. Business  
3. Tourism  
4. School/Children  
5. Roads | Homes- may be inferred from words used by the caller like my home. This could be the first assignment if no other category fits.  
Businesses- This captures businesses that are not associated with the tourism sector directly. It also includes government buildings e.g. Parliament (in the Capital which is Bridgetown).  
Tourism- Includes any reference to any segment of the tourism sector, beaches/ sand, coastal restaurants. Note that the west and south coast are main tourism areas.  
Schools/ Children- Where there is mention of children being affected, schools, or children’s homes for example.  
Roads- Any reference to any roads or transport infrastructure affected. |

F. Flooding | This theme seeks to make a differentiation between the levels of ‘flooding’ reported. It can also give some indication for later planning to address problems that may be nuisance or more significant according the categories for flooding established and the associated | 1. Flooding  
2. Stagnant water/settled  
3. No flooding |
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<tr>
<th>Theme</th>
<th>Description</th>
<th>Categories</th>
<th>Notes on categories</th>
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| **D. Drain state** | This theme captures the state of the manmade drainage system (drain, well, gutter, canal) and the natural watercourse. It also captures the type of material that may be causing the blockage. This can provide indicators for potential areas that could flood as well as more focused flood prevention programmes. | 1. Blocked/needs cleaning debris  
2. Blocked/needs cleaning/garbage  
3. Blocked or needs cleaning  
4. Natural watercourse blocked/debris  
5. Natural watercourse blocked/garbage  
6. Physical defect/safety issues | There is no differentiation between: 'blocked' and 'needs cleaning' since the reason why it needs cleaning is because it is filled with something and either one of these is a problem for managing flood waters.  
The term natural watercourse may be specifically mentioned at other times you may come across the term gully- a type of natural watercourse.  
Physical/ safety defects in the drainage system may include mention of missing covers/or open structures, broken structures. I have not separated these issues since they do not really have an impact on the flood problem. |
| **H. Health** | This theme captures one of indirect effects from the water problem which is related to breeding mosquitoes. This can have significant impacts for the health system. These linkages are known by the public and planning agencies. It would be useful however to map this as a possible use in the GIS to make connections with the importance of flood prevention from a health policy perspective. | 1. Mosquitoes  
2. No mosquitoes | There may be mention of Chikungunya or dengue, these are vector borne diseases by the mosquito. |