



A new framework for rapidly assessing national adaptation policies: an application to small island developing states in the Atlantic and Indian Oceans

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Abstract

Adapting to climate change is becoming a routine and necessary component of planning at all levels. In the case of small island developing states (SIDS), the successful development, implementation and evaluation of national-level adaptation policies are especially important because of their disproportionate vulnerability. The status of adaptation policies in these countries, however, is poorly understood and documented, particularly for the Atlantic, Indian Oceans, Mediterranean and South China Seas (AIMS) region. This is so largely because of minimal mainstream research interest in these small nations. This paper helps fill this gap. It develops an Adaptation Policy Assessment Framework that facilitates a rapid qualitative assessment of countries' national adaptation policies. It applies the framework to seven representative policies across six of the nine SIDS in the AIMS region—Comoros, Guinea-Bissau, Maldives, São Tomé and Príncipe, Seychelles and Singapore. It finds that countries are mostly successful in identifying climate and climate-related vulnerabilities and linking associated risks to other national development priorities such as poverty reduction. Countries, however, struggle with establishing and maintaining systems to review and improve adaptation interventions, which is not entirely unique to them or their circumstances. This paper's findings provide critical points of reflection for countries preparing and revising their National Adaptation Plans in the context of the United Nations Framework Convention on Climate Change. They also contribute to a broader understanding of the complexities of climate policy development in small jurisdictions.

Keywords Adaptation Policy Assessment (A-PASS) Framework · Atlantic, Indian Oceans, Mediterranean and South China Seas (AIMS) region · Climate change adaptation · Climate policy · Small island developing states (SIDS) · United Nations Framework Convention on Climate Change (UNFCCC)

Introduction

Countries around the world are already grappling with climate and climate-related changes such as increased intensity weather events, and rising sea-levels and air and sea surface

temperatures, which demand strategic actions aimed at minimizing dangerous consequences. Adapting to these changes requires a 'process of adjustment' (IPCC 2014, p. 1758) in natural and human systems that is now viewed as a viable and necessary long-term response to climate change in order to protect lives, livelihoods and ecosystems. National governments and other actors with country-wide reach and influence contribute to, participate in and/or facilitate the required adjustments across multiple sectors (e.g. see Berrang-Ford et al. 2011; Pauw 2014; Robinson 2017a, b). With limited technical and financial resources, the extent to which national governments in small island developing states (SIDS) can successfully develop and implement adaptation policies will influence the sustainability of development pathways in these countries (Robinson 2018b).

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SIDS are disproportionately vulnerable to the impacts of climate and climate-related change (Nurse et al. 2014; Robinson 2018a, 2019a). These 58 countries are located in three main geographic regions—the Atlantic, Indian Oceans, Mediterranean and South China Seas (AIMS) (the subject of this paper), Caribbean and Pacific (UN-OHRLLS 2015). While the SIDS classification is largely a political one and there is no consensus on which countries are SIDS or on how they should be defined, international multilateral agreements such as the 1992 United Nations Framework Convention on Climate Change (UNFCCC) recognise their special circumstances in terms of environment and development. These countries share common vulnerabilities, including fragile ecosystems, rapid urbanisation and population growth, narrow resource bases, difficult communications, transport and trade, and small domestic markets (see Robinson et al. 2021). However, there is significant variation across the group ‘in terms of [country] size, human and economic development, adaptive capacities, and other indicators’, including political statuses (Robinson 2020a, p. 8). Despite this, SIDS offer a common unit for the investigation of a common problem—global climate change and the development and implementation of appropriate and effective adaptation responses (Robinson 2019a).

Parties to the UNFCCC and its 2015 Paris Agreement, including the 38 SIDS that are United Nations Member States, recognise that adaptation is a multifaceted global problem that requires a country-driven, participatory and transparent response that considers vulnerable countries, communities and constituents. This response should also be based on and guided by the best available science and, as appropriate, local, traditional and Indigenous knowledge systems and peoples, with a view to ‘mainstreaming’ adaptation into national development planning and policies. In furtherance of this goal, Parties are currently in the process of developing their National Adaptation Plans (NAPs), the purposes of which are to identify medium- and long-term adaptation needs, and to develop and implement appropriate and effective adaptation responses to address those needs. Up to August 2019,¹ only 13 developing countries had submitted their NAPs, of which only two were submitted by a SIDS (St Lucia and Fiji), neither of which is located in the AIMS region (see UNFCCC 2019a). There is also evidence to suggest that national-level adaptation planning processes need feedback loops and to be better aligned with the Paris Agreement in order to promote synergies and reduce trade-offs (e.g. see Morgan et al. 2019; Woodruff and Regan 2019). In view of the first planned global stock-take of the

Paris Agreement in 2023, countries now have an opportunity to assess the quality of previously developed adaptation policies that will inform their NAPs, and to use such assessments to improve the quality of the documents that will ultimately be submitted to the UNFCCC.

This paper has two main objectives. The first is to develop an Adaptation Policy Assessment (A-PASS) Framework that can be used by adaptation policy- and decision-makers in SIDS to rapidly assess the quality of their national adaptation policies in order to inform their NAP process. The second is to apply A-PASS to a series of national adaptation policies developed by a group of countries that is understudied and underrepresented in the academic literature—SIDS in the AIMS region (see Petzold and Magnan 2019). In order to achieve its two main objectives, the remainder of the paper is organized into five sections. The first section outlines the paper’s background and context. The second section describes the methods used, including the development of A-PASS. The third section presents the results of the application of the framework. The fourth section discusses the results, and the fifth section summarises the main take-away messages, and identifies areas for future work.

Background and context

Linking national adaptation planning and the development of national adaptation policies to reporting obligations under the United Nations Framework Convention on Climate Change

The National Adaptation Plan (NAP) process was established under the UNFCCC’s Cancun Adaptation Framework in 2010 to guide adaptation planning in developing country Parties, including SIDS and least developed countries (LDCs), which are so classified based on their low national incomes, high exposure to economic and environmental shocks, and low levels of human assets (UN-DESA 2021; UNFCCC 2019a). The Cancun Adaptation Framework was intended to ‘enhance action on adaptation, including through international cooperation and coherent consideration of matters relating to adaptation under the Convention’ (UNFCCC 2019a, online). The NAP process should enable Parties to (1) develop NAPs that identify medium- and long-term adaptation needs, (2) mainstream climate risks and (3) implement strategies, programs and projects that address their vulnerabilities as well as their urgent and immediate adaptation needs. It is envisioned as an iterative process that should be country-driven, participatory and transparent (UNFCCC 2019a). The Conference of the Parties (COP) to the UNFCCC further acknowledged that climate change risks amplify development challenges for LDCs such as Comoros, Guinea-Bissau, and São Tomé and Príncipe, which are also

¹ Between August 2019 and July 2021, 11 additional developing countries submitted their NAPs, including five SIDS (Grenada, Kiribati, St Vincent and the Grenadines, Suriname and Timor-Leste).

SIDS. The COP has also recognised that national adaptation planning occurs within a broader national sustainable development context (UNFCCC 2019a).

The NAP process in the UNFCCC and the development of national adaptation policies are inextricably linked. The specific objectives of the NAP process are to (1) reduce vulnerability to climate change impacts by building resilience and adaptive capacity, and (2) facilitate adaptation mainstreaming within and across relevant sectors, at various scales, and in an appropriate and coherent manner (UNFCCC 2019a). Considering (2), this paper links national adaptation planning with the development of national adaptation policies to establish feedback loops, and to facilitate better alignment with the objectives of the UNFCCC and its Paris Agreement. Like Thomas et al. (2019), we see ‘adaptation planning’ as ‘a form of proactive adaptation’. It is ‘the use of information about present and future climate change to review the suitability of current and planned practices, policies, and infrastructure’ (Füssel 2007, p. 268). It is also the process of determining how adaptation will be carried out, when each adjustment will start and end, and the required resources and how they will be scheduled (Robinson 2017a, b, 2020b). During planning, adaptation objectives are set, practices and policies are determined, and actors and their work are identified (Robinson 2017a, b, 2020b). An ‘adaptation plan’ is the physical outcome document of this process that contains the scheduling of technical, financial and other resources. Generally, we understand policies to be any ‘position taken and communicated by governments’ (Dovers and Hussey 2013, p. 17), making an adaptation policy a government’s intentional response to adjusting to climate change impacts (see Olazabal et al. 2019). Adaptation policies are ‘presumed to be formally documented through risk and vulnerability assessments, future climate change scenarios and adaptation options assessments’ (Olazabal et al. 2019, p. 2). They include policy programs, actors, networks, responsible and/or delegated authorities and management in relation to climate adaptation at the national level (Dovers and Hussey 2013). Assessing national adaptation policies is, therefore, an important precursor to reporting to the UNFCCC.

Following Preston et al. (2011) and more recent calls for increased focus on measuring adaptation progress (see UNEP 2017, 2021), we identify three reasons for paying attention to the assessment of adaptation planning, plans and policies in SIDS. The first reason is to help ensure that actions are appropriate for local conditions, feasible and effective (see Olazabal et al. 2019; Robinson 2019a; Singh et al. 2020). The second reason is the need for investments in adaptation and related processes to be transparent, creating the need for the development of metrics and success measures in order to report to stakeholders, including the UNFCCC and other UNFCCC Parties (see Olazabal et al. 2019; Singh et al. 2020). The third reason is for lesson learning

and adaptive management (see Eriksen et al. 2021; Westoby et al. 2020). Social learning is central to the development of adaptation strategies and practices across various organisations (Orsato et al. 2018). By ‘tracking the successes and failures of different adaptation initiatives’, organisations can identify which policies are ‘effective, efficient and equitable’ (Preston et al. 2011, p. 409). This will lead to more robust national adaptation policies over time (e.g. see Doss-Gollin et al. 2019).

Climate change impacts and adaptation priorities in the Atlantic, Indian Oceans, Mediterranean and South China Seas region

Chapter 29 (Small Islands) of Working Group II’s contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, which was released in 2014, captured several studies published between 1990 and 2012 that focused on climate impacts in the AIMS region (see Nurse et al. 2014). The AIMS region is the smallest of the three SIDS regions, constituting just nine countries—Bahrain, Cabo Verde, Comoros, Guinea-Bissau, Maldives, Mauritius, São Tomé and Príncipe, Seychelles and Singapore (UN-OHRLS 2015). Though the Chapter noted a lack of available evidence and the common confusion between observed and predicted climate impacts, it affirmed that small islands, including those in the AIMS region, face disproportionate effects of climate change, particularly sea-level rise. It used work by Meyssignac et al. (2012) and others to show that not only is sea-level rising faster than the global average in the Indian Ocean, but that projected levels would render some island countries uninhabitable by 2100. The more recent Special Reports on Global Warming at 1.5 °C (see IPCC 2018), and on the Ocean and Cryosphere (see IPCC 2019) have also confirmed this (also see Duvat et al. 2021). At the same time, it is important to bear in mind that past incidents of coastal inundation and erosion are also attributable to non-climate factors such as human development, agriculture and mining, although these factors may compound future sea-level rise (see Betzold and Mohamed 2017; Ratter et al. 2016).

There is some variance in climate risk profiles across the AIMS region (see Nurse et al. 2014). This is evident across the six case study countries that we use in this paper—Comoros, Guinea-Bissau, Maldives, São Tomé and Príncipe, Seychelles and Singapore—though not much work has been done on Guinea-Bissau and São Tomé and Príncipe. By the end of the twenty-first century, Comoros is expected to reach a temperature increase of 1.99–2.35 °C, with a sea-level rise of 0.56 m and continued precipitation changes resulting in wetter wet seasons, dryer dry seasons and increased freshwater stress (Karnauskas et al. 2018). Unsustainable coastal use and coastal erosion are of particular concern (see Ratter

et al. 2016). However, ‘a lack of capacity and resources leads [...] to difficulties in enforcing rules and regulations such as bans on sand mining’ (Betzold and Mohamed 2017, p. 1077). Because of the importance of sand mining, fishing and tourism to the economy, adaptation in these sectors remains a top priority for the Comoros.

With 80% of the Maldives below 1 m above sea-level, the country is susceptible to a projected sea-level rise of 0.2–0.5 m by 2100 (Wadey et al. 2017). Harangozo (1992) found that ocean swells caused extensive erosion and damage, and identified these as potential precursors to sea-level rise impacts. A 1992 El Niño event triggered widespread coral bleaching in the Maldives (and the Seychelles) (Cinner et al. 2012; Tkachenko 2012). This has continued to worsen, and coastal flooding is increasingly induced by mean sea-level rise and wind waves (Amores et al. 2021; Wadey et al. 2017). Other projected impacts include an overall increase in average temperatures and precipitation, with some variances throughout the country (Karnauskas et al. 2018; Savage and Qi Feng 2020). Adaptation efforts have, therefore, prioritised sea-level rise, as well as minimizing climate impacts in the tourism and fisheries sectors, and to coastal populations and infrastructure.

In the Seychelles, temperatures are expected to increase 1.8–2.9 °C by 2100, along with changing weather patterns of more intense wet and dry seasons (see Staub et al. 2014). Invasive species pose biological risks, and have threatened many functionally important flora (Gaigher et al. 2011). While the Seychelles might experience relatively minimal sea-level rise (Savage and Qi Feng 2020), adaptation efforts recognize the vulnerability of the tourism and fisheries sectors to coastal impacts.

In Singapore, predictions average an increase of 2.1–3.8 °C by the end of the century, with 0.53–0.73 m rise in sea-levels (Cannaby et al. 2016). Although highly developed, Singapore is low-lying and its infrastructure is at risk of flooding (Newman 2019). Variations in rainfall patterns are affecting the flux boundary condition across ground surface—these will also negatively affect slope stability in the future (Kristo et al. 2017). Singapore is also at risk of becoming an urban heat island due to the clearing of natural land cover for dense concentrations of pavement, buildings and other surfaces that absorb and retain heat (Chew et al. 2021). Adaptation priorities have been linked to innovations to address heat-related illness and mortality, and water system independence and resource scarcity (see Chow 2018; Dedicataria and Diomampo 2019).

Despite the diversity of environmental, economic, political and social circumstances across countries in the AIMS region, including experiences of poverty and political instability, these studies illustrate that sea-level rise and water scarcity, largely resulting from coastal flooding and saltwater intrusion, are the most common threats (Robinson 2017a,

b). As a result, adaptation in the water, fisheries and tourism sectors is a top priority for national governments in the region (Robinson 2017a, b).

Status of national adaptation policies in the Atlantic, Indian Oceans, Mediterranean and South China Seas region

Like those in the Caribbean and Pacific, SIDS in the AIMS region must respond to the broad spectrum of climate and climate-related impacts they face now and will face in the future by developing national adaptation policies that are appropriate, effective, efficient and equitable. Up to August 2019, there was no comprehensive assessment of the status of national adaptation policies across all countries in the AIMS region published in the academic literature, though there have been reviews of adaptation statuses and progress that included AIMS SIDS (e.g. Dedicataria and Diomampo 2019; Klöck and Nunn 2019; Wong 2018). The limited attention paid to SIDS and AIMS SIDS, in particular, is largely the case because of minimal mainstream research interest in these small jurisdictions (see Petzold and Magnan 2019), as well as the challenges of uncertainty that manifest as problems with data and models and the selection of inappropriate spatial units (Foley 2018), though Maldives is admittedly a commonly selected case study country in the region (e.g. see Sovacool et al. 2012a, b, 2017). Petzold and Magnan (2019, p. 150) further confirmed that Cabo Verde, Guinea-Bissau, and São Tomé and Príncipe are particularly ‘under-represented in the SIDS literature compared to the other prominent island regions, i.e. the Indian Ocean, Pacific, and Caribbean’. Where assessments have been done, they typically (1) focused on a single SIDS (e.g. see Gussmann and Hinkel 2021), or (2) were not exclusive to SIDS and also included other developing countries in other regions (e.g. see Woodruff and Regan 2019), or (3) had a sectoral focus (e.g. see Vajjarapu et al. 2019), or (4) were part of an institutional or policy gap assessment (e.g. see Gheuens et al. 2019). These varied assessment approaches highlight the need for an exclusive focus on a set of critical policies developed by countries in a region that is underrepresented in the academic literature.

Methods

Case study countries and selected national adaptation policies

At the start of this study, we selected and assessed the most recent policy instrument that was also the most representative of each case study country’s national adaptation strategy, as reflected in their negotiating positions in the UNFCCC.

This resulted in the selection of seven policies across six of the nine countries in the region—Comoros, Guinea-Bissau, Maldives, São Tomé and Príncipe, Seychelles and Singapore (the other three countries in the region are Bahrain, Cabo Verde and Mauritius). Using these six AIMS SIDS as case studies contributes to the conversation on evidence-based, coordinated and systematic approaches to climate preparedness. Their selection also provided a balance between LDC and non-LDC SIDS.

In the case of Comoros, Guinea-Bissau, and São Tomé and Príncipe, which are all LDCs, we assessed their National Adaptation Programmes of Action (NAPAs), which were published in either 2006 or 2007. LDCs use NAPAs to communicate their most pressing adaptation needs and priority projects to the UNFCCC based on primary or secondary research (UNFCCC 2019b). We also assessed the Maldives Climate Change Policy Framework (2015), a second policy developed by São Tomé and Príncipe—Stratégie Nationale d'Adaptation sur les Changements Climatiques/National Strategy of Adaptation to Climate Change (2004), the Seychelles National Climate Change Strategy (2009) and A Climate-Resilient Singapore for a Sustainable Future (2016). A level of subjectivity was unavoidable in selecting these policies, but in almost all cases, the selected document was the only one that described the countries' policy programs, actors, networks, responsible and/or delegated authorities and management in relation to climate adaptation at the national level, which is in keeping with the policy components listed by Dovers and Hussey (2013). While the ages of these documents range from 5 to 17 years, they are an appropriate set of policies for assessment because they are representative of adaptation policies that LDC SIDS and non-LDC SIDS would typically develop. Additionally, AIMS SIDS are among 100+ countries that are now in the process of formulating their NAPs for submission to the UNFCCC, making this assessment not only relevant but timely.

An Adaptation Policy Assessment Framework

In order to assess the quality of the selected policies, we developed a desk-based Adaptation Policy Assessment (A-PASS) Framework and applied it to each of the seven policies selected. A-PASS is an expansion of earlier work by Baker et al. (2012, p. 131) that evaluated local adaptation plans in Australia against five components that 'reflected the primary functional parts of plan development, and thus affected the overall quality of a plan'—(1) information base, (2) vision, goals and objectives, (3) options and priorities, (4) actions and (5) implementation and monitoring. This approach laid the foundation for A-PASS.

Work by Pittock et al. (2015), Pittock (2011), Robinson (2017a, b), Sinclair and Smith (1999) and Robinson (2019b) provided guidance on the scope of the theoretical framework

and methodological choices that could be made with respect to A-PASS. Pittock et al. (2015) successfully implemented a similar small-*n* design. It examined a small number of cases in depth by comparing 11 adaptive characteristics across five climate-relevant national policies in Australia. Pittock (2011), which built on Ross and Dovers (2008), examined sustainable water management conflicts across select developed and developing countries by undertaking a policy analysis that was focused on style and detail. It illustrated how policies can be scored against simple scales, and how some aspects of policy assessments are based on the 'qualitative judgment by the author' (Pittock 2011, p. 6). Robinson (2017a, b) studied adaptation trends in SIDS and catalogued the climate- and non-climate-related vulnerabilities being experienced, the breadth of the sectors that are adapting to climate impacts and the actions being undertaken. These insights were incorporated into the assessment of policies' 'information base', 'priorities and options' and 'actions and implementation'. Sinclair and Smith (1999, p. 121), studying 'sustainable forest management attempted by disparate stakeholder organizations' in Canada, put a spotlight on the various dimensions of environmental coordination and particularly 'the approaches to working together to build consensus'. We used this to undergird our understanding of adaptation mainstreaming across policy domains. Specifically to SIDS, Robinson (2019b) crafted three guiding principles for adaptation mainstreaming along with pinpointing seven strategies for practically achieving this. These are reflected in our conceptualisation of 'vision, goals and objectives', 'actions and implementation' and 'monitoring and evaluation'. These studies and more recent ones such as Atteridge et al. (2019), Grafakos et al. (2019), Hafezi et al. (2018), Morgan et al. (2019) and Prasad and Sud (2019) helped us create a multi-layered framework for assessing the quality of national adaptation policies in the AIMS region.

A-PASS modifies the five dimensions used by Baker et al. (2012). In A-PASS, actions are paired with implementation, and implementation is separated from monitoring and is paired with evaluation. The five dimensions of A-PASS are, therefore, (1) information base, (2) vision, goals and objectives, (3) priorities and options, (4) actions and implementation and (5) monitoring and evaluation (see Supplementary material ESM). The Framework replaces the concepts Baker et al. (2012) associated with each dimension with 20 sub-dimensions. In A-PASS, 'information base' has three sub-dimensions that interrogate whether there is evidence that climate- and non-climate-related vulnerabilities, as they relate to various sub-groups in the population, sectors, localities/communities, natural and human systems and their sub-systems, are adequately understood. It also examines the establishment of links between climate change and four other domains—national/sustainable development, disaster risk reduction, resilience and transformation. **'Vision, goals**

and objectives’ has four sub-dimensions and covers whether there is evidence of high-level support for the policy and its objectives, a long-term vision, short- to medium-term goals and SMART (specific, measurable, attainable, relevant [to country context], time-bound) adaptation objectives. Another four sub-dimensions comprise ‘priorities and options’. They relate to evidence of a stock-take of community-, sector- and national-level adaptation efforts, and the clarity of national adaptation priorities, including the transparency of prioritisation processes and links to other sector policies, as well as the consideration of climate risks and various adaptation options. These align with some of the reporting obligations of UNFCCC Parties, especially LDCs (see UNFCCC 2019b). ‘Actions and implementation’ and its six sub-dimensions zoom in on evidence of implementation plans and *actual* implementation, of an authoritative body responsible for adaptation coordination, of vertical and horizontal coordination across the Government, of consideration of required resources for successful adaptation and of broad, multi-level stakeholder engagement. Three sub-dimensions comprise ‘monitoring and evaluation’. They look for evidence of the systems that are in place for adjusting adaptation priorities and reviewing actions over time.

Each of the seven policies was read by two members of our team and manually coded. A 3-point scale (yes, to some extent, no) was first applied in order to check for the presence, partial presence or absence of evidence to support each of the 20 sub-dimensions in the Framework. All the scores for each dimension were considered and a 5-point scale (high, medium-high, medium, low-medium, low) was applied. This resulted in each country’s policy receiving five overall scores, corresponding with the five dimensions of A-PASS. A third coder served as arbitrator when there was a discrepancy between the scores of the first and second coders (e.g. see Kleinheksel et al. 2020). Inter-coder reliability was 94%. Our results and discussion are presented in the two sections that follow, respectively.

Limitations

This paper’s methodological approach has a few limitations. First, it is a comparative small-*n* study. But like Pittock et al. (2015), which analysed five climate-relevant national policies in Australia, this study is among a host of others that use the most-similar method to assess national policies. This allowed us to examine cases that are as similar as possible. Second, a few of the policies assessed in this paper may appear ‘old’ as their ages range from 5 to 17 years. Despite environmental policy development being a slow process, these documents are still very much relevant today. AIMS SIDS are among 100+ countries that are now in the process of formulating their NAPs. Up to the start of our study, no

AIMS SIDS had submitted a NAP to the UNFCCC (see UNFCCC 2019a). Third, A-PASS is not exhaustive, and there are perhaps additional dimensions that could have been included. In the future, these could be determined through stakeholder consultations. Currently, A-PASS is desk-based and not meant to result in a comprehensive assessment. It is a user-friendly tool that facilitates a rapid qualitative assessment of countries’ national adaptation policies. Other studies such as Woodruff and Regan (2019) take a quantitative approach, which may create a barrier to easy application by national adaptation policy- and decision-makers. Despite these limitations, the data presented here is specific, which makes it easier to delineate patterns for individual countries and for those in the case study region.

Results

In applying our A-PASS Framework, policies’ ‘information base’ and ‘priorities and options’ scored highest. That is, our AIMS region case studies are largely successful in identifying climate-related vulnerabilities and linking climate risks to other national priorities such as poverty reduction. ‘Monitoring and evaluation’ was rated ‘low’ across the board—countries especially struggle with the establishment and maintenance of systems to review and improve adaptation actions, which is not entirely unique to these countries or their circumstances. Supplementary material (ESM) shows all scores as well as a snapshot of the evidence to allow for quick comparisons. In this section, we present select examples from each country to qualitatively illustrate variance in scores.

Information base

Singapore [High] ‘A Climate-Resilient Singapore: For a Sustainable Future’ clearly demonstrates how climate-related vulnerabilities are understood by giving specific examples of past times when Singapore experienced the effects of climate change such as the 2014 dry spell, 2015 plankton bloom and heavy rainfall in 2010, 2011 and 2013 (Government of Singapore 2016, p. 4). The different vulnerabilities discussed in the policy document address various sectors, communities and various systems and ecosystems. However, they do not focus on sub-groups in the population. In fact, there is more of an emphasis on how climate change affects the whole of Singapore, which reflects a systems approach, and which is largely missing from the other policies we assessed. Additionally, the policy was primarily developed by the Ministry of the Environment and Water Resources, and the Ministry of National Development, which suggests that there is a focus across sectors

and domains. It also suggests that national development is being linked to climate change adaptation. There is also a focus on harnessing modeling tools to be able to promote accurate long-term planning. The policy envisions adaptation measures as a method to achieve the goal of improving Singapore's resilience to climate change (Government of Singapore 2016, p. 7). The words 'transformation' and 'disaster' are not used in the document; however, there are references to future rules for infrastructure developments. For instance, future mass rapid transit stations will have to meet new flood protection requirements.

Maldives [Medium] The Maldives Climate Change Policy Framework (MCCPF) demonstrates evidence of a high level of understanding of the links between some domains, but not all. The links between climate change and national/sustainable development, and climate change and resilience are the foundations of three of the five policy goals of the MCCPF. In Policy Goals #2 (strengthening low emissions development), #3 (building climate resilient infrastructure and communities) and #5 (fostering sustainable development), the links between climate change and national/sustainable development and resilience are clear (see Government of Maldives 2015, p. 26). Each of these policy goals presents a series of objectives and strategies to achieve the goal. Even in the policy's Introduction, one of the first lines states: 'Climate change is a cross-cutting development issue as it affects every aspect of the Maldivian way of life and livelihoods ... the people of the Maldives must collectively build and strengthen our nation's resilience to combat climate change' (Government of Maldives 2015, p. 12). Thus, while the connections between climate change and sustainable development and resilience are at the core of the MCCPF, there is little mention of the connection between climate change and disaster risk reduction, and no mention of the connection between climate change and transformation. There is mention of the need to 'prepare the detailed island risk assessment plans, tools, and guides for selected islands in the Maldives', but it is unclear if this is specifically for disaster risk reduction (Government of Maldives 2015, p. 30). There are no other mentions of disaster risk reduction or transformation, or their links to climate change, within the policy framework.

Vision, goals and objectives

Seychelles [Medium–High] While the Seychelles National Climate Change Strategy (SNCCS) outlines six action steps to enable the 'establishment of sustainable long-term monitoring programmes in strategic areas, with focus on climate scenarios, risk assessments and adaptation' (Government of Seychelles 2009, p. 73), and two additional steps

to be implemented on a 'long-term' timescale, the policy is mainly focused on short- and medium-term objectives. Two of these 'long-term' objectives include 'reinforc[ing] approaches for sustainability in fisheries through improvements in monitoring and management of fishing zones' and 'evaluat[ing] and implement[ing] new plant varieties, strategies for pest and invasive control for agriculture and forestry, to cope with changed climatic conditions' (Government of Seychelles 2009, p. 78). In contrast, the short- and medium-term objectives have defined time periods that vary between 1 and 5 years. The relative lack of long-term goals is a shortcoming also highlighted in Seychelles' 2015 Intended Nationally Determined Contributions document, which states that 'it is critical that Seychelles take measures to better understand the threats and begin longer-term planning for adaptation' (see Government of Seychelles 2015, p. 4).

Comoros [Low-Medium] The only high-level support evident in Comoros' NAPA is the preface signed by the Minister of State for Rural Development, Fisheries, Handicrafts and Environment. This letter, however, reads as more of a plea for help than an endorsement of the NAPA's contents. While the NAPA authorship clearly articulates the importance of high-level support in the implementation of its goals, it is unclear whether commitment was confirmed by those who would ultimately be tasked with pursuing its objectives. Finalised in 2006, all projects within the NAPA are listed to be undertaken in the following 3 years, a clearly short-term set of objectives. Additionally, the NAPA lists 13 projects and their estimated costs—a total of US\$3.702 million (Government of Comoros 2006, p. 46). They include defense and restoration of degraded soils, increase in water supply, fight against malaria, introduction of fish aggregating devices, early warning systems and support to eye, medical and surgical care (Government of Comoros 2006, p. 46). Each effort has an associated two- to three-page project sheet with more detailed information. The goals are, however, largely immeasurable and not time-bound. It is, therefore, difficult to assess their attainability without a measurable benchmark.

Priorities and options

Guinea-Bissau [Medium–High] There is evidence to suggest that Guinea-Bissau's NAPA team prioritized adaptation actions according to (1) level of seriousness, (2) contribution to poverty relief, (3) synergy with multilateral environmental agreements, (4) costs, (5) gender and (6) number of beneficiaries, each on a 5-point scale. There is also evidence to suggest that the NAPA document considers priorities in other key documents: 'A group of representatives from

different public agencies and civil society assembled in a workshop, identified particularly vulnerable sectors and population groups under the National Strategy on Poverty Reduction, and [took] into consideration findings of sector studies on vulnerability and adaptation to effects of climate change' (Government of Guinea-Bissau 2006, p. 48). There is, however, little mention of the role of civil society in this regard. And while there is only tangential discussion of the risk of climate change on national priorities, one criterion for adaptation projects is their 'contribution to poverty relief, which estimates the level of impact of probable effects of the adaptation option on improving populations' living conditions' (Government of Guinea-Bissau 2006, p. 47). This implies consideration of this risk. Finally, hard options such as the construction of wells and latrines were considered part of a project to improve water quality and access. Soft options such as education in coastal areas and the rehabilitation of mangroves for fisheries adaptation were also considered (see Government of Guinea-Bissau 2006, pp. 76, 80).

São Tomé and Príncipe [Medium] Sao Tomé and Príncipe's NAPA contains evidence to suggest that the country's national priorities for adaptation are clear. The document lists the activities the country proposes. It also states that each is prioritised using multi-criteria analysis. Despite this, there is no description of the prioritisation criteria, nor consideration of other national policies (Government of São Tomé and Príncipe 2006, p. 24). The NAPA methodology, which led to the development of priorities, included 'public consultation with participation of all stakeholders, fundamentally the local communities' (Government of São Tomé and Príncipe 2006, p. 24), which is the approach that the UNFCCC prescribes. Additionally, the extent of local opinions on national priorities is unclear, but there are indications that at least some degree of consultation occurred.

Actions and implementation

Comoros [Medium–High] A basic outline of goal implementation exists within Comoros' NAPA; however, detailed explanations and step-by-step plans are sparse. A large emphasis is placed on a communication strategy to help coordination between sectors. Each project contains 'objectives', 'activities' and 'implementation'; the latter section lists the Ministry/ies and body/ies responsible for carrying out the action. However, there is little instruction besides a statement of this duty, assuming a degree of competence and autonomy within each implementing organisation. Project Sheet #6, for example, entitled 'Fight Against Malaria' only indicates 'under implementation', pointing out that the

project will be carried out by a 'multisectoral pilot committee for each island under the supervision of the Island Ministry of Environment, with the coordination of the Union Minister in charge of Environment' (Government of Comoros 2006, p. 63). Furthermore, some 'follow-up and evaluation indicators' are listed but, again, with no further details (Government of Comoros 2006, p. 63). There is also no mention of the implementation status of ongoing adaptation projects—the NAPA merely contains aspirations for the future and states that 'strictly speaking, there is not yet a real policy on climate change' in Comoros (Government of Comoros 2006, p. 42). The NAPA appears to be the first step in this direction.

Maldives [Low-Medium] In the MCCPF, there is almost no reference to the resources required for implementation. Policy Goal #1 (ensuring and integrating sustainable financing in adaptation) briefly references the objective of 'advocat[ing] for and ensur[ing] the delivery of predictable and sustainable financial resources from the developed countries ... to support the implementation of climate change measures' (Government of Maldives 2015, p. 27). Though this brief mention of financial resources suggests some consideration of required resources, there are no further details. The document acknowledges that there are three 'building blocks' of the strategy, which include technology transfer, finance and capacity development, but there is no elaboration of the accessibility and feasibility of these building blocks. There is also no evidence of specific considerations for financial amounts or values for resources required, and potential sources. Additionally, one of the objectives is 'to strengthen human, technical, regulatory and institutional capacity for climate change adaptation and mitigation measures' (Government of Maldives 2015, p. 16), but no further details are given as to the required level of human or technical resources, and how it will be achieved.

Monitoring and evaluation

Comoros [Low] In the case of Comoros' NAPA, little emphasis is placed on anything beyond implementation. As a result, besides the oversight committees on each respective island and a national commission related to the NAPA, there is no mention of the monitoring and evaluation of projects. All projects are grouped within the general time frame of 2006–2009. Similarly, there is no information regarding past, present or future reviews. Given that the NAPA is effectively introducing adaptation in Comoros, it is unsurprising that a model for evaluation was not already well embedded in the relevant governance processes.

Singapore [Low] The Climate-Resilient Singapore for a Sustainable Future policy mentions that adaptation measures will be refined, and new ones will be implemented, as needed. There is no time period set for revisiting priorities. The Resilience Framework is situated as a means of redefining the priorities, but it is unclear which organisations would do so and at what time. Monitoring and review are part of the Framework but there is no clear outline as to when this would occur. Stakeholders are not mentioned in the context of reviewing adaptation actions. The ‘next steps’ section of the policy reads: ‘[W]e will continue to monitor climate change impacts closely and study their effects on Singapore’ (Government of Singapore 2016, p. 29). It is unclear who ‘we’ is in reference to in this context, but we deduced that they are the parties overseeing the review of its adaptation needs. The Resilience Framework further suggests that monitoring and reviewing are taking place, as well as the prioritisation of adaptation measures, but there were no details beyond that.

Discussion

In assessing representative national adaptation policies in select AIMS SIDS, we find that policies’ ‘information base’ and ‘priorities and options’ are strongest, particularly with respect to identifying climate-related vulnerabilities and linking climate risks to other national priorities such as poverty reduction. These policies’ ‘monitoring and evaluation’ are weakest in all the nations studied. This is consistent with Woodruff and Regan (2019, p. 53) that found that adaptation plans in 38 countries from Albania to Zambia ‘are weaker in the articulation of implementation and monitoring measures’. Without monitoring and evaluation, it is difficult to develop effective policy frameworks, whether said frameworks are climate-related and irrespective of the jurisdiction, be it Australia (e.g. see Pittock et al. 2015; Webb et al. 2013), the European Union (e.g. see Brouwer et al. 2013; Nesshöver et al. 2017) or the USA (e.g. see Fu et al. 2017; Gilmore and St. Clair 2018). Additionally, our assessment shows that there are gaps in countries’ adaptation policy development that require urgent attention: (1) linking adaptation and disaster risk reduction, and climate change and transformation, (2) addressing the needs of various acutely vulnerable and underserved population sub-groups, e.g. Indigenous groups, (3) involving civil society in assessing vulnerability and reviewing adaptation actions and (4) determining how modeling tools can be used to promote accurate long-term planning, and the specific capacities needed to achieve this. These gaps bring into focus questions around the institutional arrangements for adaptation and whether they actually support the development of quality policies. The gaps also signal the need for a closer look at the roles

of timescales and uncertainty in policy development, and of climate research in mitigating this uncertainty and appropriately aligning national adaptation priorities.

Institutional arrangements for adaptation, and adaptation limits

While this paper did not set out to investigate the institutional arrangements for adaptation in our case study countries, they are an important contributor to policy quality (see Cuevas 2018). Our findings suggest that the national or central government is the main driver of adaptation action, though this may be the case because of our focus on the UNFCCC—only national governments are Parties to the Convention. This aside, each country has a named government ministry dedicated to environmental protection and responsible for developing and implementing adaptation policy, programs and projects. Singapore’s policy, for example, was primarily developed by the Ministry of the Environment and Water Resources, and the Ministry of National Development (see Government of Singapore 2016). This suggests that there is a focus across sectors, as well as that the environment and development domains are being linked through policy coordination. The links to national/sustainable development and resilience are evident in Policy Goals #2 (strengthening low emissions development), #3 (building climate resilient infrastructure and communities) and #5 (fostering sustainable development) of the MCCPF in the Maldives. The document was developed by the Climate Change Department in the Ministry of Environment and Energy, with stakeholder consultations that included the GIZ, a German development agency (see Government of Maldives 2015). These observations are consistent with Robinson (2017a, b) which found that national governments are involved in all adaptation actions in SIDS, followed by other country governments (bilateral), donors and development banks.

The role of civil society organisations in adaptation policy development in the AIMS region is, however, ambiguous and usually blanketed by broad statements suggesting ‘wide stakeholder consultation’. Guinea-Bissau’s NAPA, for example, acknowledged that: ‘A group of representatives from different public agencies and civil society assembled in a workshop, identified particularly vulnerable sectors and population groups under the National Strategy on Poverty Reduction, and [took] into consideration findings of sector studies on vulnerability and adaptation to effects of climate change’ (Government of Guinea-Bissau 2006, p. 48). But depending on governance structures and specific institutional arrangements, the importance and contribution of these organisations appear to vary across our cases. Comoros’ NAPA identifies two oversight bodies to increase the reliability of adaptation coordination—each island has an eight-pronged committee comprising vulnerable groups, and a 12-pronged national

commission made up of various government ministries and civil society organisations (see Government of Comoros 2006). Despite the apparent collaboration across these two sectors, non-governmental organisations remain dependent on the support of central governments, which is but one of several relationship models (see Coston 1998). Any ‘political restrictions [...] undermine [their] legitimacy’ (Banks et al. 2015, p. 707) and non-governmental organisation participation in adaptation agenda-setting can be regulated by the government, which results in a weakened civil society. In the Maldives, participation in public policy development is heavily regulated by the President and stakeholder consultations are sometimes rarely held (e.g. see Clark Howard 2018; Rasheed and Abdulla 2020). Despite this, non-governmental organisations ‘retain an important potential role as bridge-builders’ (Banks et al. 2015, p. 707). As a result of this, they can ‘support the independent action of other civil society groups’ in an effort to push for greater inclusion and broader engagement in activities such as assessing vulnerability and reviewing adaptation actions, in an effort to address adaptation limits (Banks et al. 2015, p. 707).

While there is evidence to support the assertion that more than a third of the adaptation limits faced by SIDS are institutional in nature, the top ten limits across the sampled AIMS SIDS in Robinson’s (2018b, p. 270) study were (1) finances/budgetary restrictions/income, (2) land area/availability/use, (3) data/records, (4) human resources/manpower/turnover, (5) capacity to predict climate impacts, (6) modelling software/models, (7) size, (8) natural resources/features, (9) public awareness, knowledge and ownership and (10) capacity to adapt (not otherwise specified). Seychelles, for example, mostly reported being limited by finances (Robinson 2018b). This is surprising as the Seychelles is generally proactive in attracting international adaptation finance, and has been successful in devising innovative financing mechanisms, including a first-of-its-kind debt-for-climate swap (Robinson et al. 2021; Warland and Michaelowa 2015). None of the sampled AIMS SIDS in Robinson’s (2018b) study reported being limited by factors such as the focus or scope of national institutions/policies/legislation/regulations, or poor inter-agency communication/coordination. This suggests that limits in other domains such as physical/ecological and social may be more critical. For example, Seychelles’ status as an archipelago challenges the timely and cost-effective implementation of adaptation programs/projects, which is common in many archipelagos, irrespective of the program/project type (e.g. see Melo et al. 2020).

Timescales, uncertainty and national adaptation policy development

This study finds that many national adaptation policy goals in the AIMS region either are not time-bound or are

associated with unrealistic timeframes. The SNCCS in the Seychelles, for example, is mainly focused on short- and medium-term objectives, and the Ministry of Environment and Public Utilities Corporation was given just 1 year to ‘implement [a] nationwide rainwater harvesting programme’ across 116+ islands (Government of Seychelles 2009, p. 78). All projects listed in Comoros’ NAPA, as another example, are listed to be undertaken over 3 years, a clearly short-term set of objectives. These timescales are certainly at odds with ‘the long-term, uncertain nature of localised climate change impacts and associated vulnerabilities’ (Herrick 2018, p. 81).

Benjamin and Thomas (2018) and Foley (2018) are among those that argue that there are many sources of uncertainty and that these have grave implications for climate change knowledge production and adaptation policy- and decision-making in SIDS. These sources include data and model limitations (Hafezi et al. 2018), which create the need for more scale-appropriate data on climate exposure, impacts and vulnerabilities that can be used to inform adaptation needs and efforts (Robinson 2018b). They also include issues related to the ambiguous definition of concepts, inappropriate spatial units and lack of confidence in underlying assumptions. However, if AIMS SIDS are understudied and underrepresented in the academic literature (Petzold and Magnan 2019), it then raises questions about the sources and quality of the ‘information base’ underpinning the national adaptation policies assessed in this paper. Robinson (2018b) reported that three information base-related factors—data/records, capacity to predict climate impacts and modelling software/models—are among the top ten factors limiting adaptation in AIMS SIDS. Singapore’s policy was among the few that emphasised harnessing modeling tools for promoting accurate long-term planning, signaling the importance of modeling capability under uncertainty for effective and equitable adaptation policy- and decision-making in SIDS.

The role of climate research in mitigating uncertainty and aligning national adaptation priorities

Climate research is a key factor in mitigating uncertainty in adaptation policy development and assessment. Building technical and financial capacity for climate research in SIDS is important. Benjamin and Thomas (2018) call for capacity upscaling in tertiary institutions across SIDS to increase the opportunities for climate research, as do Khan et al. (2018) in the broader context of developing countries. In the AIMS region, there is scope for strengthening the capacities of several universities and for the implementation of institutionalised research exchanges between higher ranked and lower ranked universities. The National University of Singapore,

which is ranked 11th of universities worldwide (two spots ahead of the Ivy League Princeton University in the USA), according to the 2019 QS World University Rankings, was established in 1905, and has an endowment equivalent to roughly US\$2.9 billion. It could be paired with the University of the Seychelles, for example, which was established in 2009, which is currently without rank or endowment, but which is striving to be recognised as a regional knowledge hub. There is also a role for regional organisations such as the Indian Ocean Commission in pooling governance to better meet the capacity building needs of Member States and to establish operational links between universities and central planning and development ministries in Member States (following Kelman 2016; Robinson and Gilfillan 2017). Increasing awareness of the Commission and similar supranational organisations at the local level can also be a first step in mobilising local support for various adaptation interventions (see related discussions in Middelbeek et al. 2014).

Climate research is also important for aligning national adaptation priorities with actual and expected climate change. National-level planning should be based on the best available science with enough built-in flexibility for modifications, once new data is unearthed. Our study finds that the links between climate change and national/sustainable development, and climate change and resilience are the foundations of three of the five policy goals of Maldives' MCCPF. The policies of Comoros and Guinea-Bissau were also equally well-aligned—this is likely the case because of their LDC status and the emphasis on poverty reduction as a key component of sustainable development in low-income countries. Alternatively, the explanation offered by Hardee and Mutunga (2010, p. 117) could be applicable—that there are 'structural differences between development plans and NAPAs, both of which ought to be undertaken in a participatory process, with a multidisciplinary approach and a sustainable development perspective'. The authors recommend 'longer-term adaptation strategies that better meet the development needs of countries' (Hardee and Mutunga 2010, p. 113). These strategies should be developed by national governments in partnership with other stakeholders with country-wide reach and influence.

Lessons for cross-regional learning

In developing longer term adaptation strategies, it is important to consider which stakeholders should be involved, why and how. Generally, successful adaptation at the national level depends on governments as well as the active, inclusive and sustained engagement of stakeholders, including civil society, local public and private sectors, and regional and international organisations, among others. Woodruff and Regan (2019, p. 53), in their review of the quality of national adaptation plans, concluded that plans 'written by

multi-agency committees are significantly higher quality than those written by single agencies, especially on engagement of stakeholders'. While our methodology did not facilitate the testing of the influence of specific stakeholders over the content, quality and/or utility of the policy documents, which can be incorporated into a future research design, this study finds evidence of the prioritisation of reliable coordination among authoritative bodies in Comoros, for example. There are two oversight bodies: each island has an eight-pronged committee, and there is a 12-pronged national commission. In some instances, however, these constituted top heavy committees. In other instances, stakeholders are not mentioned in the context of reviewing adaptation actions. Work by Holler et al. (2020) using LDCs as case studies, however, challenges whether broad stakeholder engagement is needed for the development of national adaptation policies. It establishes precedence for the ways in which adaptation policy- and decision-making processes are organised at the national level, which is imperative in countries with scarce technical and financial resources. SIDS governments across the three geographic regions should take this into account.

Adopting a systems approach to responding to climate change is important for successful adaptation in SIDS. Singapore's policy, for example, places more of an emphasis on how climate change affects the entire country, which is largely missing from the other policies we assessed. There is evidence to suggest that Guinea-Bissau's NAPA considers priorities in other key documents: 'A group of representatives from different public agencies and civil society assembled in a workshop, identified particularly vulnerable sectors and population groups under the National Strategy on Poverty Reduction, and [took] into consideration findings of sector studies on vulnerability and adaptation to effects of climate change' (Government of Guinea-Bissau 2006, p. 48). However, there are particular challenges with integrating adaptation with disaster risk reduction. Carby (2018) and Nalau et al. (2016) documented these for Caribbean and Pacific SIDS, respectively. In the MCCPF, for example, there is little mention of the connection between climate change and disaster risk reduction, and no mention of the connection between climate change and transformation. These considerations and connections are important for increasing adaptation success.

Conclusion

This paper set out to (1) develop an A-PASS Framework that can be used to assess the quality of national adaptation policies in order to inform countries' NAP process, and (2) apply A-PASS to a series of adaptation policies developed by SIDS in the AIMS region. A-PASS is a new tool that

policy-makers in SIDS and other low-resourced jurisdictions can use to conduct a rapid, qualitative assessment of their national adaptation policies. In applying A-PASS, this paper finds that national SIDS governments are mostly successful in identifying climate and climate-related vulnerabilities and linking associated risks to national development priorities such as poverty reduction. Countries, however, struggle with establishing and maintaining systems to review and improve adaptation interventions, making it difficult to ascertain their effectiveness. Our assessment also identifies four key gaps that require urgent attention: (1) linking adaptation and disaster risk reduction, and climate change and transformation, (2) addressing the needs of acutely vulnerable and underserved population sub-groups, e.g. Indigenous groups, (3) involving civil society in assessing vulnerability and reviewing adaptation actions and (4) determining how modeling tools can be used to promote accurate long-term planning, and the specific capacities needed to achieve this. While this paper did not set out to study the institutional challenges and/or opportunities related to national-level adaptation across AIMS SIDS, this is an area for future research. Such a study could delve into the differences and limits across countries, and determine whether current adaptation institutions are appropriate for developing and implementing NAPs in the context of the UNFCCC.

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