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Identifying local governance capacity needs for implementing climate change adaptation in Mauritius

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ABSTRACT

The IPCC 1.5°C Report lists identifying local capacity needs as key for enabling multi-level governance to effectively respond to climate change. Mauritius, as a Small Island State, is disproportionately affected by climate change, primarily due to its exposure to impacts, as well as various constraints in size and resources. Identifying and integrating local capacity needs into recommendations for policy measures is therefore urgently required to support the United Nations Framework Convention on Climate Change and its National Adaptation Plan process. This study carries out a local governance assessment based on evaluative criteria to identify local capacity needs for implementing climate change adaptation in Mauritius. Results from the assessment indicate that local governance suffers from issues inherent to Small Island States, such as lack of technical know-how, financial and human resources, stringent legislation and effective monitoring mechanisms, preventing effective climate change adaptation. Through participatory, bottom-up stakeholder engagement with local and national government representatives, eight recommendations for policy formulation were then co-developed to address the identified capacity needs, and to improve cooperation between local and national institutions for more effective implementation of climate change adaptation.

Key policy insights

- Local climate change adaptation needs have to be integrated into policy formulation for an effective response to climate change impacts.
- Roles and responsibilities of government levels for climate change adaptation in Mauritius are currently in need of clarification.
- Capacity building measures at the local level for implementing climate change actions from national government are urgently required.
- Stringent legislation and effective monitoring mechanisms need to be implemented to ensure planning regulations are adhered to.
- Increased collaboration between local and national levels of government in Mauritius is necessary for synthesizing a common approach to climate change adaptation.

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1. Introduction and background

A key outcome of the Resilient Cities conference 2018 was drawing attention to the urgent need for global support for adaptation strategies in Small Island States (SISs) (ICLEI, 2018). SISs are vulnerable to climate

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change impacts through their exposure to sea-level rise, increasing frequency and intensity of tropical storms, increased variability in rainfall patterns, as well as warming air and sea surface temperatures (IPCC, 2014). The environmental challenges faced by Mauritius largely coincide with those faced by other SISs, including higher incidence and intensity of extreme weather events, such as heavy rains and storms of tropical cyclone strength or higher (MMS, 2018). Combined with socio-economic challenges such as high coastal population densities, geographic isolation, high dependency on international markets, and low resource abundance, this makes Mauritius and other SISs more prone to experiencing loss of lives, livelihoods and shelter, as well as damage to social and economic systems and environmental degradation (Kelman & West, 2009; Robinson, 2018).

The unrelenting progression of climate change (IPCC, 2018a) necessitates innovations in governance systems to deal with climate change impacts. Increasing capacity for climate change adaptation through enhancing governance effectiveness, defined as the successful process of decision-making by a configuration of state, private and non-governmental organizations, and institutional arrangements to achieve desirable outcomes (Adger et al., 2003; Ojwang et al., 2017), can significantly decrease the impacts of climate change (Pahl-Wostl et al., 2013). Innovations in multi-level governance systems need to take the political setting of SISs into account to create the means of identifying context-sensitive, bottom-up and community-led solutions producing equitable, efficient and effective outcomes (Adger et al., 2003; UN, 2009).

The research fields of vulnerability and resilience need to therefore carefully explore and augment the role of governance (Sjöstedt & Povitkina, 2017; Williams et al., 2019). The effectiveness of multi-level governance, understood as the sharing of power across global institutions, regional organizations, and national and sub-national governance (Schakel et al., 2015), is often impeded in climate policy processes through a lack of coordination between national and local governance levels. Importantly, national policy planners insufficiently consider local capacities for implementing climate change adaptation measures. It is therefore argued that effective multi-level governance for climate change adaptation necessitates close collaboration and co-operation between these political scales (Leck & Simon, 2013).

As the impacts of climate change are primarily experienced locally, locally-driven action is key (Agarwal et al., 2012; Baker et al., 2012). The focus on local governance, understood as the political and institutional processes through which decisions are taken and implemented in a specific sub-national geographic region (UCLA, 2019), is reflected in the National Adaptation Plans (NAPs) adopted under the United Nations Framework Convention on Climate Change (UNFCCC), in which greater consideration of local actors as implementers of climate change adaptation is strongly recommended (Di Gregorio et al., 2019; UNFCCC, 2017). Shouldering the 'burden of action' (Pasquini et al., 2015), local governance is tasked with, amongst other issues, incorporating climate risks in development plans; mobilizing resources for adaptation; adjusting building and land use regulations to consider climate risks; and enhancing disaster preparedness, response and recovery (Baker et al., 2012; Corfee-Morlot et al., 2011; Reisinger et al., 2011).

Individual and societal vulnerability to climate change is often determined by the availability of resources and influenced by institutional dynamics (Adger et al., 2003). It is therefore critical not only to assess the capacity of local governance systems to implement climate change adaptation and to identify capacity needs, but to address capacity needs in recommendations for climate-smart policy formulation (Shakya et al., 2018). This is again reflected in the NAPs, which aim to 'facilitate the integration of climate change adaptation [...] into relevant new and existing policies and activities, in particular in development planning processes and strategies [...] at different levels' (UNFCCC, 2015).

Local governance is complex and diffuse, situated at the base of the multi-level governance hierarchy, and beset by resource limitations. At the same time, local governance is deemed an essential entity in multi-level governance for implementing climate change adaptation measures. The relationship between governance, policy, and implementation is complex, and the inconsistencies of local governance highlight the need for a versatile methodological approach to elucidate operational challenges at the local level. The methodological approach of this research is based on the premise that governance actors come together to form policies to be implemented for generating effective results and attaining substantive objectives (Koliba et al., 2017; Newig & Koontz, 2013). However, improved policy planning does not necessarily lead to improved implementation as it is difficult to predict outcomes that largely depend on the capacity of policy implementers, which is to an extent determined by governance effectiveness (Koliba et al., 2017).

The IPCC underlines the need to strengthen institutional conditions which enable climate change adaptation, since ‘the ability to scale up beyond the local remains challenging and little examined’ (IPCC, 2018b). Enabling conditions for climate change adaptation can be defined as emergent properties of diverse forms of capital, which society draws upon in response to, or in anticipation of, climate stresses (Nelson et al., 2007). At the local level such enabling conditions include a multi-dimensional approach that is needed due to the complexity of local adaptation processes. Assessing the capacity of adaptation managers and practitioners in this context remains a serious challenge (Gupta et al., 2010).

Against this background, this study has as its first objective an assessment of the capacity of local governance to implement climate change adaptation policies in Mauritius drawing on a multi-dimensional evaluative framework encompassing social, political, human, financial and environmental criteria (Carmona et al., 2017). This provides the basis to address the second objective, of co-developing recommendations for policy formulation to strengthen local governance for climate change adaptation using a participatory process. Hence, this paper explores concepts of assessing effective multi-level governance that can enable climate change adaptation at the local level.

2. Case study site

Mauritius is located in the Western Indian Ocean. It is 2,040 km² in size, with a coastline stretching over 177 km, and surrounded by coral reefs (UNDP, 2018). The climate of Mauritius is tropical, with dry winters from May to November, and hot, wet and humid summers from November to May. Average temperatures have already risen by 0.74°C – 1.2°C compared to pre-industrial levels, with further warming at the rate of 0.15°C per decade projected (MMS, 2018).

Sea-levels have risen at an average rate of 1.5 mm/year since 1950, accelerating to 2.1 mm/year since 1987. An increase has been observed in the incidence and intensity of extreme weather events, including heavy rains and storms of tropical cyclone strength or higher. This has led to Mauritius being ranked 13th for greatest disaster risk and 7th for exposure to natural hazards globally (MOSSNESD, 2017a). Impacts of climate change are primarily experienced through heavy rainfall events causing inundation and flash floods, landslides and water logging in low-elevation areas. Sea-level rise also causes coastal erosion, and an increase in ocean temperature has led to widespread coral bleaching (MOSSNESD, 2017b).

Mauritius has a population of 1.2 million. Its local government is formed by various local authorities established and governed by the provisions of the Local Government Act, no 36 of 2011, and falls under the oversight of the Ministry of Local Government (MOSSNESD, 2017a). Local authorities include eight District Councils and Port Louis municipality, and 130 Village Councils (MOSSNESD, 2017b). The main statutory duties of District Councils are maintenance of roads, environment and public sanitation, culture, leisure and sport, and education. Their activities are organized under six main departments, namely Administration, Finance, Land Use and Planning, Public Infrastructure, Public Health, and Welfare (CLGF, 2012).

The Ministry of Social Security, National Solidarity, and Environment and Sustainable Development (MOSSNESD), which is responsible for coordinating actions on climate change, states that it is within the remit of District Councils to ‘proactively address the prevention, protection and preparedness to the adverse effects of climate change and extreme events’ in Mauritius (MOSSNESD, 2017a). Thus, as a clearly defined governance entity with a specific set of activities, the governmental level of District Councils was selected in this study as the entry point for assessing capacity needs for climate change adaptation.

3. Method

This study combines two approaches, namely (1) a Capital Approach Framework (CAF) to assess the capacity of local governance for implementing climate adaptation and (2) participatory interactive workshops to co-develop appropriate recommendations for policy formulation based on the results of the CAF (refer to Figure 1).

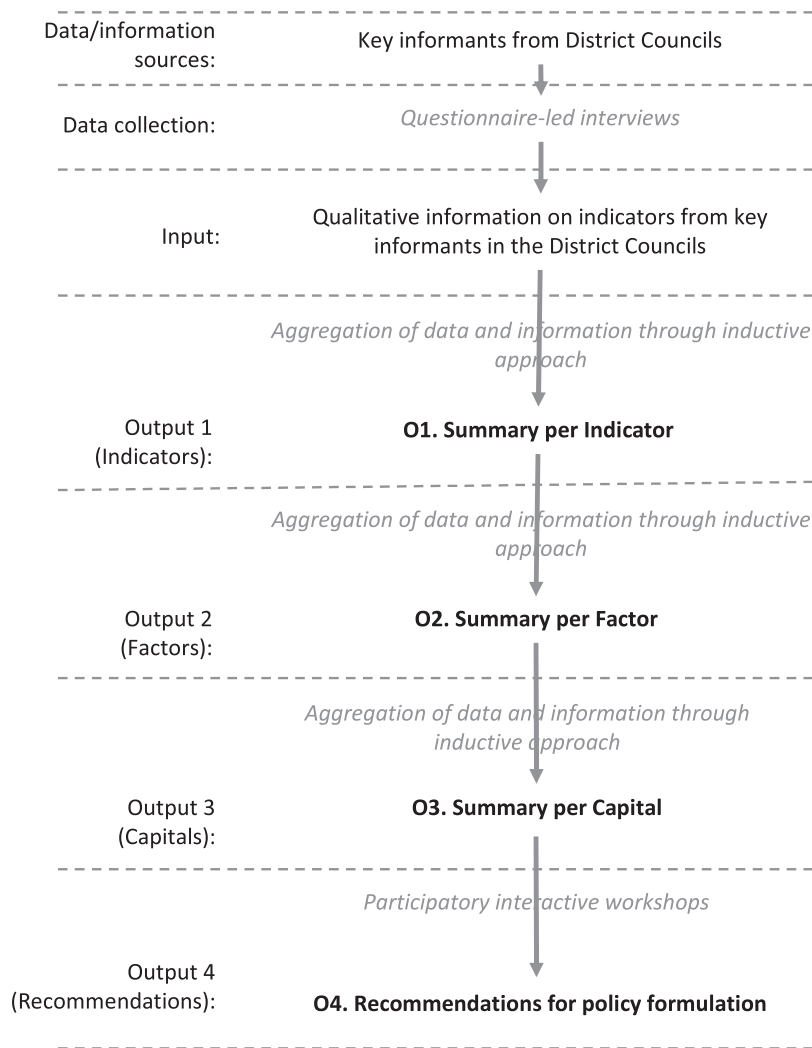


Figure 1. Data and information collection and analysis process applied in Mauritius. Adapted from Celliers et al. (2020).

3.1. Capital approach framework

The CAF addresses the first objective of the paper. As one of the first generation adaptive capacity frameworks, the CAF can be used to set a governance baseline, or an analysis of the functioning of an existing governance system, identifying capacity needs which then become a reference point against which future changes in governance systems can be assessed and measured (Máñez Costa et al., 2014; Mortreux & Barnett, 2017; Olsen et al., 2009). A governance baseline is a highly valuable tool not only to monitor progress, but also to inform the practice of adaptive governance, or governance that learns from its experience and responds to changing conditions (Olsen et al., 2011). The CAF has five dimensions, termed as capitals: social, political, human, financial, and environmental, which together capture the functioning of a governance system (Máñez Costa et al., 2014). Social capital includes internal and external collaboration on climate change issues, stakeholder participation and the sharing of information. Political capital covers institutional organization, political support and level of transparency. Human capital consists of available human resources, as well as access to knowledge and skills. Financial capital comprises the availability of funds for climate change adaptation and disaster preparedness, and environmental capital encompasses environmental management strategies, as well as the level of

ecosystem protection. For a deeper inspection of each capital, see Máñez Costa et al., 2014; Carmona et al., 2017; Ojwang et al., 2017; or Williams et al., 2018.

It has been argued that applying indicator-based frameworks for comparative case study analysis and developing benchmarks as specific thresholds for what constitutes effective governance is not necessarily desirable or appropriate, as local conditions of climate change adaptation vary significantly from location to location (Baker et al., 2012; Dilling et al., 2019; Ojwang et al., 2017). Hence, each application of the CAF must be carefully modified by adjusting the evaluative criteria in accordance with the local context of climate change adaptation needs (Williams et al., 2018). Identifying which evaluative criteria are relevant for each local context requires local expert knowledge and detailed document analysis, including reports, planning guidelines, and environmental regulations. Having carried out expert interviews and document analysis, this study used a modified, context-sensitive CAF to understand how these five capitals combine and interact to impact on the ability of local governance to initiate and sustain climate change adaptation from a multi-dimensional perspective, revealing the capacity needs of local governance for implementing climate change adaptation in Mauritius.

Guided by a hierarchical knowledge approach, each capital – understood as a capability, resource, property, or other valuable that can be mobilized to produce sustainable outcomes – was measured by a set of factors, and the factors were in turn evaluated by a set of qualitative indicators which chart climate change adaptation needs (Figure 1) (Shakya et al., 2018; Williams et al., 2018). First, key informants from district councils provided qualitative information on indicators in questionnaire-led interviews. The qualitative information on indicators was then aggregated through an inductive approach to the factor level. This involved condensing and summarizing the raw contextual data, establishing connections between the research objectives and the data, and identifying underlying structures and patterns evident in the data (Thomas, 2006). The same process was repeated for aggregating data from factor level to the capital level, producing an overall governance baseline.

The strength of a capital was determined by whether the factors and indicators of the relevant capital, to which questions during the questionnaire-led interviews pertained, received positive or negative responses, i.e. performed strongly or poorly. The full list of factors and indicators pertaining to Outputs 1 and 2 of Figure 1 can be found in the Supplementary Material. Responses were characterized as binary, ordinal and cardinal unit measures, and assigned a colour according to their performance. Positive responses were depicted in green, varied responses in yellow, and negative responses in red. For conciseness, only the summary per capital (Output 3, Figure 1) is depicted in the main body of this article.

The coastal District Councils of Pamplemousses, Rivière du Rempart, Flacq, Grand Port, Savanne, and Black River were included in the study, as this is where climate change impacts are most pronounced. The questionnaire-guided interviews were conducted over a four-week period in August 2017 with planning, finance, and human resource departments in each of the coastal District Councils, as these municipal line functions dealt with the issues most relevant to the study, such as environmental management, infrastructure planning, risk management, and financial budgeting. The interviews were held at the offices of the respective District Councils, and each interview was approximately 45–60 min in duration.

3.2. Participatory interactive workshops

To achieve the second objective of co-developing recommendations for policy formulation, understood as suggestions or propositions for ‘a definite course or method of action’ (FAO, 2008) to support ‘the regulated agent’s flexibility with respect to the choice of abatement strategy’ (OECD, 2007), the method of participatory interactive workshops was deemed most appropriate (TESS, 2010). When working together with local stakeholders to co-develop recommendations for policy formulation, it is important not to over-design, but rather encourage local government members to drive an inclusive, reflective, context-specific and unpredictable process for achieving reform (Shakya et al., 2018). Participatory workshops can also enable high quality democratic governance and strengthen civil capacity through involving local communities (TESS, 2010). Further expected benefits include building confidence and trust in policy formulation, mutual learning among participants through the sharing of information, data, and experience, as well as ensuring that outcomes reflect context-specific knowledge and expertise which may have otherwise not been considered (Moyson et al., 2017; Slocum, 2003).

A District Council participatory workshop took place on 20 March 2018 at the Mauritius Oceanography Institute (MOI) in the town of Albion. It was attended by 14 representatives from all but one of the District Councils included in the assessment. The workshop was facilitated by three project members, one of which was from a Mauritian institution. The workshop was organized around a plenary discussion and deliberation on the management objectives of District Councils in relation to climate change adaptation. The results of the CAF were also presented and validated. This was done by asking participants to either agree or disagree with 12 key findings, 2–3 from each of the capitals, which were previously chosen on the basis of commonality amongst respondents and relevance from the District Councils, and prepared by the facilitators. These confirmed key findings were then used as a basis for discussion on how to enhance the capacity of local governance to implement climate change adaptation, reflecting the needs identified in the assessment. Recommendations for policy formulation were then devised in small groups of 3–5 participants and presented back to the plenary. These were then deliberated and reformulated to compile a list of eight policy measures which were contextualized in relation to the session on management objectives of District Councils for climate change adaptation, and to the strengths and weaknesses of local governance identified during the governance assessment (Output 4, Figure 1).

A National Government participatory interactive workshop took place on 22 March 2018 at MOI and was attended by 17 representatives from various Ministries, non-governmental organizations (NGOs), external research institutions and three project members. After a plenary discussion on the management objectives of local governance in the context of climate change adaptation, the validated findings from the assessment were presented and debated at length. In the afternoon, the eight recommendations for policy formulation from the District Councils were discussed and evaluated, and in some cases amended for feasibility (Output 4, Figure 1). The decision to hold the District Council and National Government participatory workshops separately was made on local advice to encourage a more frank and open debate.

4. Results

Responding to the first objective, Figure 2 shows the capital receiving most positive responses was environmental capital, followed by social and financial capital. Receiving the lowest amount of positive responses were political and human capital. The 12 key statements chosen to validate the findings of the CAF were agreed by members of the District Councils. In the following sections, the main outcomes of each capital are presented.

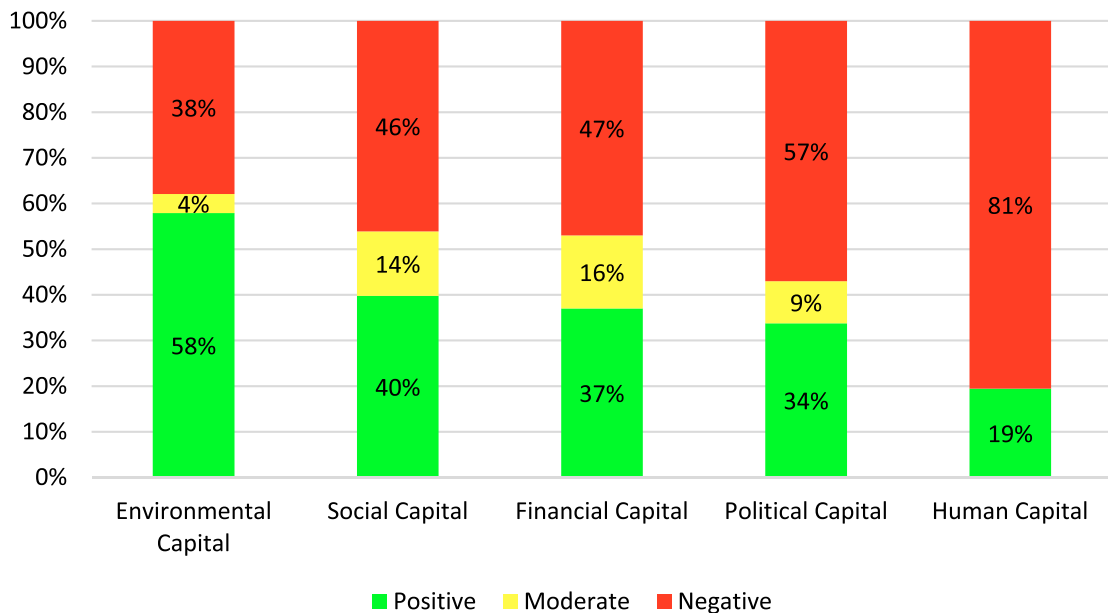


Figure 2. Assessment of the capacity of local governance to implement climate change adaptation policies in Mauritius.

4.1. Environmental capital

With an overall positive answer rate of 58%, environmental capital received the most positive evaluation. District Council members had a high awareness of the importance of ecosystems to the region's economy. The vulnerability of coastal regions to climate change was further recognized, with flooding cited as the most frequently experienced hazard, and issues of coastal erosion, coral degradation, land- and rockslides also raised. The participants unanimously acknowledged the impact of climate change on the natural environment. There was general agreement concerning the insufficient implementation of environmental legislation, policies, guidelines and strategies protecting the environment, particularly safeguarding environmentally valuable land from development. As a consequence of ineffective planning, the loss of green areas for percolation of precipitation is increasing the risk of flash flooding. Effective implementation of environmental legislation is especially challenging due to a lack of appropriate monitoring mechanisms in place to supervise infrastructure developments after planning permits have been awarded. Participants further highlighted a lack of usable information on the natural environment for appropriate urban and land-use planning, as well as infrastructure development (i.e. location of wetlands).

During the District Council workshop, participants emphasized the need for greater guidance and technical know-how on how to integrate environmental recommendations into Planning Policy Guidelines (PPGs), as well as for more rigid guidelines for the implementation of environmental recommendations for climate change adaptation. Updated risk maps indicating environmentally fragile zones, such as coastal or wetland areas, floodplains, or demarcation of canals and rivers, should be made available and integrated into the PPGs. On occasions when National Government over-rides planning decisions made by District Councils, greater consideration should be given to environmental concerns. The preparation of action plans for specific regions or areas affected by climate change could also enhance preparedness.

During the National Government workshop, participants recognized that access to environmental data in the form of risk maps is a challenge, not only for District Councils, but also for National Government. It was argued that the high financial cost of risk maps meant their dissemination among all District Councils was a challenge. Improving Geographic Information System (GIS) capabilities at the local level was a more viable option, as District Councils could then develop and update their own risk maps. There was also agreement on the need for more guidance for integrating climate change information into decision-making tools such as the PPGs.

4.2. Social capital

Generally, results for social capital indicate a lack of routine collaboration between District Councils. In contrast, external stakeholders are integrated into decision-making and policy planning processes. While few participatory forums or cross-sectoral projects have been initiated by District Councils themselves, some do take part in networks or forums aimed at knowledge and information exchange on climate change initiated by other partners. Accessibility and usability of information provided by National Government to help District Councils plan for climate change received exclusively negative responses. The need for improved access to relevant and recent environmental and climate data presented in a pragmatic way, in particular more comprehensive maps of flood-prone areas and wetlands, was emphasised.

During the District Council workshop, participants observed that improved cooperation between themselves and the Ministries was urgently needed. There should be mandatory consultations with the respective District Councils when development projects are planned and carried out in their respective jurisdiction. Mechanisms assuring a regular exchange of information between District Councils and National Government on environmental issues and projects would also facilitate improved cooperation. Increased collaboration and sharing of expertise with NGOs was also suggested, as NGOs are often more involved in sensitization programmes and community education.

During the National Government workshop, all participants acknowledged the need for improved collaboration and coordination between District Councils, Ministries, NGOs and other actors in addressing climate change issues in Mauritius. One suggestion on how to improve this issue was to establish an external think-tank comprised of multi-sectoral actors deliberating independently from National Government. Due to the

cross-cutting nature of climate change issues, the think-tank would assist in collaborating and mediating between affected stakeholders and devise strategies and opportunities for climate change adaptation.

4.3. Financial capital

Financial capital received a positive response rate of 37% and a negative response rate of 47%. A major lack of funds was identified as the main inhibiting factor for District Councils not implementing climate change adaptation. The overall expenditure of District Councils on climate change adaptation was, however, still considered to be limited. Conversely, disaster risk management measures responding to external stressors are in place and implemented in all District Councils effectively, with half having allocated funds specifically for disaster risk management. However, when asked to rate their respective council's expenditure on disaster risk management, only moderate or negative evaluations were given. Disaster risk management is mainly reactive and therefore refers to historical events, and climate projections are not considered in current disaster risk management practices. The majority of councils are aware of funding opportunities for climate change at the national and international level, and most have prepared proposals for adaptation funding. However, the application process has been described as inefficient. In those cases where applications were made, approval was rarely granted.

Throughout the District Council workshop, participants highlighted the need for a dedicated fund for climate change issues and actions to improve financial capital. This would allow them to implement specific climate change adaptation measures and to organize events and workshops with stakeholders and local communities to educate and raise awareness on climate change issues. It could also help in maintaining and rehabilitating public infrastructure, particularly in flood prone areas.

In the National Government workshop, participants suggested that District Councils prepare a plan of actions and interventions they want to undertake, and then look for funding at national and international levels for implementation. The issue of District Councils not being able to apply directly for international funding without the approval of National Government was raised. However, participants felt this could be overcome by seeking approval from parent Ministries.

4.4. Political capital

Political capital received a negative response rate of 57%. The turnaround time for permits (14 days) was highlighted as a major constraint, as this creates pressure to disregard environmental concerns in favour of short-term economic gains. There are no climate adaptation plans or strategies at the local level, and councils lack an internal structure for taking charge of, and coordinating, climate change issues. In the context of climate change, the roles and responsibilities of District Councils are not clearly defined. Additionally, participants reported a low level of political support on climate change issues from National Government.

In the District Council workshop, participants suggested a greater role and responsibility in regulation before, during, and after building construction, especially in post-monitoring. This could be supported by a more stringent policy framework, as well as the ability to initiate own projects, and not only assist local governance in the implementation of pre-determined climate change projects. The 14-day turnaround for planning permits should also be extended to consider environmental concerns.

During the National Government workshop, representatives agreed that District Councils could play a greater role in climate change adaptation, mainly through implementation of awareness raising projects and education of local communities on issues related to the environment and climate change. For greater involvement of District Councils in climate change adaptation, participants highlighted the need for close coordination with Ministries and other actors to avoid duplication of efforts and ensure they contribute to overall national adaptation objectives.

4.5. Human capital

Human capital received the poorest evaluation, with only one District Council having access to external technical support to help deal with the consideration of climate change in urban, land-use, and infrastructure planning.

While all councils have physical planners, there are no coastal engineers to call upon for consultation or advice. Very few District Councils have participated in the necessary capacity building actions on climate change, resulting in a lack of know-how and inadequate guidance on technical reports, as well as on implementation of key recommendations. The lack of know-how is further compounded by loss of expertise through staff turnover, adding to the general lack of staff dealing with environmental issues. Additionally, there are no climate change leaders, officers or champions with formally recognized roles at District Council level.

During the District Council workshop, a trained and dedicated team from a multi-disciplinary background to deal with climate change issues for every District Council was proposed, containing engineers, architects, specifically designated officers, and consultants. The need for capacity building and simulation exercises on climate change issues was also highlighted, in particular to improve knowledge and discussions around the exchange and dissemination of new climate change information.

National Government representatives suggested the team should be formed from within their existing human resources. They could approach the Ministry of Environment to provide training for this team on specific skills required. Participants recognized that there was scope for the appointment of one climate change or environmental management officer per District Council. This officer would be responsible for articulating climate change responses across the various departments and between neighbouring District Councils, and to seek collaborations with National Government, NGOs, and other stakeholders to assist in implementing specific actions.

4.6. Co-developed recommendations for policy formulation

Responding to the second objective, [Table 1](#) depicts eight recommendations for policy formulation co-developed with both local and national government representatives to strengthen local governance for climate change adaptation. These find support in the climate change adaptation literature and cover a number of issues that are relevant to other SISs.

5. Discussion

The local governance assessment of District Councils in Mauritius identified the capacity needs of local governance in implementing climate change adaptation. The validation of the local governance assessment findings by representatives of the District Councils confirms the legitimacy and usefulness of the CAF as an analytical tool for examining and evaluating local governance processes (Máñez Costa et al., 2014).

5.1. Examining the findings of the local governance assessment for Mauritius

The incidence of climate-induced natural hazards in Mauritius has created an active and aware civil society, permeating into local governance authorities, and enhancing the evaluation of environmental capital. It also confirms findings that show those communities which experience climate change impacts are more knowledgeable on climate change issues (Roggero & Thiel, 2017). Experiential familiarity with climate change at the local level is key for implementing climate change adaptation in SISs with an increasing recognition of the important role of bottom-up, community-led adaptation processes (Betzold, 2015; Juhola & Westerhoff, 2011).

The main statutory duties of District Councils include the management and maintenance of infrastructure, which is being impacted and damaged by climate change, straining the daily operations of local governance. The needs and capabilities of decision-makers were not well-aligned with available and usable information on the natural environment. This is a common issue in the field of climate change adaptation both in low- and high-income regions, with continuing improvements in the technical quality and usability of information on the natural environment, including appropriateness of spatial and temporal scale, and capacity building efforts highlighted as key areas for improvement (Mullan et al., 2013; Vincent et al., 2017).

In addition to technical quality and usability of information, the lack of information sharing and collaboration can be a further impediment to effective integration (WeAdapt, 2017), captured in the evaluation of social capital. A lack of adequate and appropriate information is a well-established problem inherent to SISs, and has shown to have a negative impact on collaboration and coordination on environmental issues (Betzold,

Table 1. Recommendations for policy formulation co-developed with local and national government representatives in Mauritius and validated in climate change adaptation literature.

#	Recommendation for policy formulation	Relation to capital	Validation in climate change adaptation literature
1	To undertake a comprehensive review of which environmental and climate information could be provided to District Councils in order to help them make better planning decisions, particularly those which effectively consider climate risks.	Human, Political	Adger et al. (2005), Dilling (2007)
2	To consider which changes in the land-use planning system would guide District Councils in integrating climate information into planning processes.	Human, Political	Mycoo and Donovan (2017), Roberts (2010), Roberts and O'Donoghue (2013)
3	To establish the training and capacity building needs of District Council staff working in departments where climate change is or will become an issue of concern, in order to deliver targeted training on adaptation.	Human, Social	Shakya et al. (2018)
4	To assess the feasibility of employing officers in District Councils specifically to deal with climate change, environment and sustainability issues. These officers would work with other staff across the District Councils to ensure the integration of climate change, environmental and sustainability considerations in all relevant District Council services, and to facilitate dialogue and coordinate actions across levels of government and other actors.	Human, Environmental	Desportes and Colenbrander (2016), Mycoo and Donovan (2017), Pasquini et al. (2015)
5	To consider the organization of annual local government adaptation summits, as well as providing the opportunity to share information and best practice, identify challenges, and deliver specific training workshops.	Human, Environmental, Social	Pelling et al. (2008), Preston et al. (2011)
6	To embed climate action across levels of government in order to determine how National Government and District Councils can best work together to manage the impacts of climate change and build community resilience.	Political, Social	Bulkeley and Betsill (2005), Mycoo and Donovan (2017), Turnheim et al. (2015)
7	To clarify the roles and responsibilities of each level of government with regards to dealing with climate change risks. This involves mapping the range of climate impacts onto existing legislation and the roles and responsibilities of different levels of government, identifying overlaps and gaps.	Political	Bulkeley and Betsill (2005), Roberts (2010)
8	To investigate options to make funding available to District Councils for adaptation actions. Such actions should be integrated in, and contribute to, the national Climate Change Action Plan.	Financial	Corfee-Morlot et al. (2011), de Águeda Corneloup and Mol (2014)

2015; Janssen, 2014). Learning conditions and coordination are enabled through establishing mechanisms for collaboration and the sharing of information (WeAdapt, 2017). When designing mechanisms for enhancing collaboration, it is important to involve a diverse group of stakeholders, including local experts, authorities outside of government, the private sector, and affected communities (Maidl & Buchecker, 2015; Shakya et al., 2018).

Findings for political capital show how climate change impacts are further reshaping the role and operating space of District Councils by critically altering the nature of regulatory functions, such as the issuing of construction and land use permits. This is a particular problem in SISs as environmental issues such as land degradation, biodiversity loss, and marine pollution are exacerbated by climate change (Betzold, 2015). The regulatory component is essential due to the diversity of sectors and stakeholders across all tiers of the multi-level governance system impacted by and responding to climate change (Mullan et al., 2013). There is however a gap between consideration of environmental issues in regulatory legislation, and experienced climate change impacts. In Mauritius, District Councils are not provided with the appropriate legislative tools and are thus unable to adequately address the concerns of their constituencies, particularly those affected by floods, erosion, landslides, and other climate-related impacts which are projected to increase significantly.

Findings from both financial and human capital show how, in spite of these risks, local authorities lack the legal mandate, resources, and technical know-how to successfully implement climate change adaptation. District Councils identified a considerable gap between their level of exposure to climate change risks, and their mandate and resources, including staff and technical know-how, which determine their ability to take effective action. To fulfil obligations to their constituencies in relation to climate change adaptation, they

urgently require financial support and capacity development to increase technical knowledge and process-oriented skills such as inclusive facilitation and monitoring and evaluation of policies and measures (WeAdapt, 2017). Financial support and capacity development are key challenges, or even bottlenecks, to the implementation of climate change adaptation, and funding requirements are rarely openly discussed in strategies and plans set by National Government (Mullan et al., 2013). This would also be important to reflect in the policy planning process for actioning Table 1, as implementation and monitoring are common barriers to effective climate change adaptation at the local level.

The local governance assessment revealed that climate change adaptation in Mauritius is designed and enacted as a top-down process. Top-down approaches have, however, been found to be impractical and inappropriate in SISs, as these often lack the resources at the local level to effectively enforce legislation (Betzold, 2015). Enhancing capacities in order to lend greater autonomy to local authorities is even more important in the context of climate change adaptation as decentralization has shown to lead to improved cooperation and decision-making (Agarwal et al., 2012; Roggero & Thiel, 2017). In principle, National Government agreed that District Councils should play a greater role in climate change adaptation. However, there was a divergence concerning the appropriate extent of an enhanced role of District Councils in climate change adaptation. While some representatives from National Government viewed District Councils as the appropriate authoritative entity to initiate climate change adaptation actions, other representatives argued that an increase in responsibility should be primarily focused around raising awareness in local communities about climate risks. Tensions regarding the distribution of competencies have been highlighted as a common barrier in multi-level governance systems (Di Gregorio et al., 2019). Similarly, the role of Village Councils in Mauritius needs to be considered, as empowering community leaders who are sometimes ill-informed about National Government policy can be highly beneficial to successful climate change adaptation in SISs (Betzold, 2015).

5.2. Relevance of recommendations for policy formulation in other SISs

While SISs are heterogeneous in terms of physical and human geographies, they share common sustainability and development challenges (de Águeda Corneloup & Mol, 2014; Kelman & West, 2009). The close proximity between national and local tiers of government, combined with constraints in terms of size and resources, can often lead to power imbalances between the different tiers of governance (Pelling & Uitto, 2001). In particular, the dominance of national over local interests in policy planning processes has been found to decrease the effectiveness of multi-level governance systems (Di Gregorio et al., 2019).

This study offers a clear methodological pathway for integrating local climate change adaptation knowledge and experience into recommendations for policy formulation, identified previously as a key knowledge gap (Ryan & Bustos, 2019). Recommendations developed in participatory processes are more likely to flow into decision-making and policy learning processes and ultimately influence policy change (Moyson et al., 2017; Vindrola-Padros et al., 2019). This is highly valuable for SISs, which have highlighted improved uptake of local knowledge and experience into decision-making systems and policy-planning processes at the national and global level as a priority (de Águeda Corneloup & Mol, 2014).

The policy recommendations (Table 1) cover several issues inherent to SISs. One issue raised is the unsustainable use and extraction of resources (Kelman & West, 2009). Local governance in SISs is subject to various political and operational constraints, such as powerful vested interests promoting development on sites at risk (Mycoo & Donovan, 2017). The pursuit of an economic growth-centric paradigm in infrastructure planning processes at the cost of the environment is particularly prevalent in SISs, which are often characterized by a narrow economic base and limited pool of skills, a high economic dependency on mainland or continental countries for markets and investment, and a paucity of natural resources (Bass & Dalal-clayton, 1995; de Águeda Corneloup & Mol, 2014). In light of external pressures for continued economic growth, this dynamic is likely to be enforced, and environmental policies need to be reformulated and prioritized (Recommendation 2 and 4, Table 1) (Singh, 2014).

There is also an urgent need for financial assistance for climate change adaptation across SISs (Robinson, 2018). Enhancing the role of finance in international negotiations was also highlighted by the Alliance of Small Island States (AOSIS) at the 2018 Katowice Climate Change Conference (Thomas & Schleussner, 2018). Enabling access to financial support mechanisms at the local level could facilitate bottom-up adaptation and

strengthen vertical integration of climate change adaptation through multi-level governance (Recommendation 8, Table 1) (Dodman & Mitlin, 2013). Access also enables funding bodies to provide resilience planning to those most at risk in SISs (Mackay et al., 2018). [To enhance access to financial support mechanisms, local actors require external support to address issues around eligibility and procedure (Robinson, 2018). This has to take place in close coordination with higher levels of governance to identify priorities and to ensure projects are in line with national adaptation strategies (Recommendation 5 and 6, Table 1).

Capacity needs across SISs have received limited recognition by international development organizations, with staff lacking the appropriate training and know-how to implement recommendations from higher levels of governance (Mackay et al., 2018). This is compounded by a lack of organizational structure, hindering collaboration and cooperation on climate change issues (Mackay et al., 2018). Installing climate change officers has shown to be beneficial in other examples (Desportes & Colenbrander, 2016; Pasquini et al., 2015). Lending increased responsibility to local governance actors for strengthening multi-level governance processes has also proven beneficial in enhancing local capacity to coordinate cross-boundary issues such as climate change (Gruby & Basurto, 2013). Building local institutional capacities is essential for climate change adaptation and resilience in SISs, demanding a high priority in agenda-setting forums (Mycoo & Donovan, 2017). For effective local governance systems to decrease the vulnerability of SISs, the appropriate legislative means need to be made available to initiate and implement climate change adaptation actions (Recommendations 3 and 7, Table 1).

6. Conclusion

The reality that climate change is having a profound impact on the operating space of local governance in Mauritius is inescapable. Mauritius, as a SIS, has a complex network of actors that all play an important role in local adaptation. The small geographical size of the island does not translate to concomitantly smaller or less significant issues for local adaptation. Neither does it scale to simpler organizational arrangements and greater capacity to act on local adaptation. The proposed policy recommendations in support of local adaptation are important and relevant to Mauritius and other SISs. Equally so is the process of understanding governance capacity, expressed as forms of capital, and how to use the output of the assessment to co-develop recommendations for policy formulation by both local and national governance, as demonstrated in the study. Future prospects could include the prioritization between strengths and weaknesses to identify which capacity-enhancing measures have the greatest chance of affecting system wide change.

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