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Title: Identifying and lifting climate adaptation barriers in Mauritius using a participatory approach

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Abstract

Purpose: The purpose of this working paper is to present an innovative and participatory methodology to identify and overcome climate adaptation barriers and an example of its application in Mauritius.

Design/methodology/approach: The approach builds upon stakeholder mapping (i.e. Net-Map) and uses barrier and practical actions cards to support stakeholders through the process of identifying together potential adaptation barriers and potential actions that can be implemented to overcome them. The approach was used in workshops in four Small Island Developing States (SIDS): Jamaica, Mauritius, Seychelles and St Lucia. In each island, the workshops involved national and local level actors from three sectors: agriculture, fisheries and tourism. In Mauritius, although a representative from the tourism sector was involved in the workshop, only two activity groups were formed for the workshop: one for the agriculture sector and one for the fisheries sector.

Findings: In Mauritius, the methodology highlighted the predominance of the national government and national organisations in planning and implementing climate adaptation actions and the still limited inclusion of local actors in adaptation. It also allowed the identification of two adaptation barriers. One can already be overcome with the implementation of the practical actions devised by the activity group and within the capacity and institutional context of Mauritius. The other barrier identified is more deeply rooted and will need to be addressed subsequently.

Originality/value: The participatory identification of adaptation barrier and how to overcome them could be a successful planning process that reconciles national adaptation policies with the implementation of local adaptation actions. It involves different stakeholders devising solutions that not only are in the line with national adaptation policies but also are a step towards reducing vulnerability against climate extremes at local level. Prioritising the identified barriers that are surmountable and

that can already be addressed within the islands' capacities would be the beginning of building climate resilience at national and local level.

Introduction

Small Islands Developing States (SIDS) are particularly vulnerable to the effects of climate change due to their limited size, geographical dislocation, proneness to natural hazards and external shocks, high exposure of population and infrastructure and limited adaptive capacity.

Although SIDS are among the least emitters of GHGs, they are likely to suffer strongly from the adverse effects of climate variability and change and could in some cases even become uninhabitable. Additionally existing and forthcoming challenges related to climate variability and change are just some of many pressing problems that most SIDS face. Their socio-economic concerns include poverty alleviation, high unemployment, and the improvement of housing, education and health care facilities – all of which often compete for the slender natural and financial resources available.

Adaptation measures are central to addressing the challenges posed by climate variability and change in SIDS. But under their existing circumstances, adaptation will require innovative solutions involving stakeholders across different geographical scales and sectors and the integration of adaptation into existing sectoral policy initiatives in areas such as sustainable development, planning, disaster prevention and management, integrated coastal management, and health care.

But some barriers still persist and the implementation of adaptation actions at local level remains scarce. This paper presents and innovative, participatory methodology to identify these adaptation barriers as well as potential ways to overcome them. This methodology was used successfully during a workshop in Mauritius, and covered 2 sectors of activities: agriculture and fisheries. The results from the workshop are summarised here along with some recommendations on next steps.

Background

Mauritius' current climate is already changing; analyses run by the National Meteorological Office over historical weather data show a definite warming trend as well as a decreasing trend in annual rainfall for Mauritius. A lengthening of the intermediate dry season, the transition period between winter and summer, has also been observed together with a shift in the start of the summer rains. This shift already translates into more pressure on the water sector to meet increasing demands for the agriculture, tourism, industrial and domestic sectors. Additionally, despite the number of rainy days found to be decreasing over the years, heavy rainfall events leading to numerous flash floods and temporary interruptions of certain socio-economic activities during the summer months of February and March have increased. The frequency of extreme weather events, heavy rains and storms of tropical cyclone strength or higher, has increased significantly over the last two decades. The future projections for Mauritius point towards a projected annual increase in temperature by the 2080s spanning 1-3˚C and a decrease in annual rainfall of -20 to +18 mm per month (-21% to +16%) by 2080s under scenario A2.

Mauritius is already realising the effects of climate variability and changes are now occurring at a faster pace than ever before. Mauritius has recognised that much effort is needed to reduce the impacts of climate change on the natural and human environment of the country and significant progress has been made in environmental policies and regulations. In line with the sustainable-growth objective of the Maurice Île Durable (MID) programme, the Mauritian government introduced a form of carbon tax and 'green' taxes in the 2011 budget to improve energy efficiency and scale up renewable energy (African Economic Outlook, 2012). Mauritius also integrated a review of the potential impacts of climate change into its Environmental Impact Assessments (EIAs); EIAs are to be conducted before undertaking major construction/development projects (Hove et al., 2011).

Mauritius was also the first country to ratify the UNFCCC, showing its early awareness and commitment to addressing climate change. In 1991, Mauritius established a multi-sectoral National Climate Change Committee involving a variety of institutions and organisations, including several ministries and representatives of the private sector and NGOS. Its mandate is to monitor developments of science of climate change and its possible impacts on key sectors of the economy. In 1999, Mauritius released its Initial Communication to the UNFCCC. Mauritius is also addressing disaster risk management through the Hyogo Framework of Action, implementing a comprehensive early warning system that also supports adaptation to climate change (Hove et al., 2011). In 2010, Mauritius released its second National Communication to the UNFCCC, pointing that greatest impact of climate change in the coming years will be in the form of increasing exposure to natural disasters and that to address this, the earlier emphasis on risk reduction and preparedness now needs expanding to include a broader focus on longer-term adaptation. In 2012, Mauritius adopted its National Climate Change Adaptation Policy Framework (NCCAPF), which highlights the adaptation priorities for the country in the priority sectors of water, agriculture, fisheries and tourism (with gender and health considered as cross-cutting priorities). A Climate Change Bill for Mauritius is also forthcoming and due to be presented at the National Assembly in 2014.

Whilst the above constitutes a significant degree of government activity in climate change related areas, there is still room in Mauritius to mainstream climate adaptation considerations into key institutional/ sectoral goals, to improve inter-ministerial collaboration and to link national adaptation policies with local implementation of adaptation actions and overcome some adaptation barriers.

Adaptation barriers referred to here are defined as "any condition that makes it difficult to achieve progress towards adaptation" (Huang et al., 2011) or as "obstacles that can be overcome with concerted efforts, creative management, change of thinking and related shifts in resources, land use institutions etc." (Moser and Ekstrom, 2010).

Limits to climate adaptation differ from barriers as they are absolute obstacles that render adaptation to climate change ineffective and as such cannot be overcome (Adger et al. 2007). However, barriers to climate adaptation differ from limits in that they are obstacles that can be overcome with (Moser and Ekstrom 2010).

Adaptation barriers are expected to constrain how adaptive capacity to future climate change might be translated into action (Ford and Pearce, 2010) and deeply influence

the likelihood of successful adaptation strategies at local level (Burch, 2010). Understanding the nature of barriers to climate adaptation is important (e.g. Patt and Schroeter 2008; Adger et al. 2009; Nielsen and Reenberg 2010) and even more so to find strategic ways of overcoming them. Current understanding of these barriers in SIDS is however very limited. This paper summarises the results from the participative assessment of barriers to climate change adaptation in Mauritius. It also presents some of the implementable practical actions devised by sectoral stakeholder groups to overcome these barriers. The assessment of the barrier and the formulation of practical actions follow a unique participative methodology presented in the next section.

Methodology

In trying to gain a better understanding of the possible barriers underlying the disconnect between national adaptation policies and local implementation of adaptation actions in the specific context of Mauritius and how to overcome them, a one-day workshop was organised. Before the workshop, some desk studies were carried out to better understand the context of the island.

The workshop formed an integral part of the GIVRAPD project. The CDKN project: “Global Islands’ Vulnerability Research, Adaptation, Policy and Development” is a 2-year research project in 4 coastal communities in the Caribbean (Jamaica and St Lucia) and the Indian Ocean (Mauritius and Seychelles). It seeks to understand the multi-scale socio-economic, governance and environmental conditions that shape vulnerability and capacity to adapt to climate change.

The workshop in Mauritius included representatives of local organisations as well as national organisations, covering three sectors identified as most vulnerable to climate impacts: agriculture, fisheries and tourism. However, although a representative of the national Tourism Authority was present at the workshop, s/he joined another group and as such no tourism activity group was formed for this workshop and the participants concentrated only on two sectors: agriculture and fisheries.

Three main activities were planned throughout the workshop. The first group activity was to identify the existing stakeholders involved in adaptation planning and implementation for one of the sector and to assess ‘horizontal’ and ‘vertical’ linkages/relationships between the various stakeholders. The linkages captured were: a) information/advice, b) funding and c) line of command/authority/action. The activity also looked at the influence of each actor on the implementation of adaptation activities at local level. The stakeholder mapping methodology used for this activity dwell from the Net-Map protocol (Schiffer E., 2007).

The second activity of the workshop aimed to: i) gain a group consensus on the critical barrier related to the implementation of adaptation measures for a sector and ii) identify the underlying causes behind the chosen barrier. The groups had access to a list of possible barriers and possible causes and were invited to prioritise one barrier they thought was the most significant for the sector. Each group had to fill one “adaptation barrier” card detailing the chosen barrier (i.e. name of the barrier, cause, organisation/person responsible for the barrier and who could lift the barrier). The groups were also free to come up with their own “off-list” barriers and causes or modified the ones from the lists.

The last activity aimed to identify strategies and actions that could contribute to overcome the causes driving the adaptation barrier identified in the second activity. The groups had access to a list of possible adaptation good practice actions but were also free to come up with their own. Each group had to fill in one "adaptation good practice action" card per barrier identified. The emphasis on the adaptation good practice action" card was on the implementation and feasibility of the action(s) chosen (i.e. who is responsible to implement the adaptation action, how, the resources needed and measures of the effectiveness of the action).

The second and third activities iteratively referred to the stakeholder maps devised at the beginning of the workshop to try and identify the actors that are responsible for the barriers and those who can lift the barriers (sometime the same, sometime different). The two activities, using "adaptation barrier" and "adaptation good practice action" cards were developed as a practical application of Moser and Ekstrom (2010).

The advantages of using stakeholder participation in the assessment of barriers and formulation of practical actions are many folds. Firstly, involving stakeholders into drawing the network maps allows them to visualise how their organisation or themselves fit into the network. Then, all stakeholders present during the workshop can express their opinions in-situ and these can spark further discussions between participants, thus enabling reaching consensus on the adaptation barriers identified and the possible ways to overcome them. Furthermore, bringing different stakeholders from different backgrounds, communities, literacy proficiencies together allows them to bring their points of view across and possibly clarify opinions and ideas.

A lot of consideration was given during the workshop to appease ethical worries that participants might have had. For example, as participants expressed their concerns over their discussions being recorded, no notes were taken during their group discussions throughout the workshop. In not doing so, collecting additional information might have been compromised but the authors felt that respecting the wishes of the participants was of greater importance.

Results

Agriculture sector

This activity group on agriculture brought together participants from national (e.g. Ministry of Agro-Industry and Food Security, Mauritius Meteorological Services ad the Sugar Insurance Fund Board) as well as local organisations and individuals (e.g. Local NGO for Petit Sable and local farmers).

The network of stakeholders for this group is very detailed and includes sub-level actors, for example sub-divisions of organisations as well as the different flows between them. The actors found to have the most connections to the other actors were the Ministry of Agro-Industry and Food Security (MAIFS) and the Ministry of Finance and Economic Empowerment in Mauritius (MoFEE). The participants of this group also noted the actors having high influence over the implementation of

adaptation at local level to be the actors with the most connections (i.e. MAIFS and MoFEE) as well as the Climate Change unit of the Ministry of Environment and Sustainable Development, International donors (e.g. FAO, UNDP, EU, WMO) and the Commission de l'Océan Indien (COI). Some international donors (e.g. SADC/COMESA, NEPAD, UNEP GEF Small Grant Programme) as well as national and local actors (e.g. national: Meteorological Services; Research Councils, such as the Mauritus Research Council and the Food and Agriculture Research Council; University of Mauritius; Mauritius Sugar Industry and Research Institute. e.g. local: Small Farmers Welfare Fund; Local NGOs and cooperatives; farmers associations) were found to have a moderate influence over the implementation of adaptation actions. It is interesting to note however that the only local-level actor noted to have the highest influence was the Mauritius Agricultural Marketing Cooperative Federation Ltd.; this actor is also linked to other actors through all the flow connections investigated (i.e. funds, information and line of action).

Information seems to flow well between international and national actors. Information from international actors streams mainly through the Ministry of Agro-Industry and Food Security, the National Meteorological Services, and the Ministry of Finance and Economic Empowerment. Some links from international organisations also go to the Climate Change Division of the Ministry of Environment and Sustainable Development. At national level, information seems to be well-exchanged between national actors; information is reciprocal between the Ministry of Agro-Industry and Food Security (including different divisions with this Ministry such as the Agricultural Research and Extension Unit, the Quarantine Office, the Entomology Unit), different national research institutes (e.g. Mauritius Sugar Industry Research Institute, University of Mauritius, Mauritian Research Council and the Food and Agriculture Research Council) and other national ministries (e.g. Ministry of Finance and Economic Empowerment, Maurice Ile Durable Commission).
However, at national level it is worth noting that no information link was represented from the National Meteorological Office or the Climate Change Division of Ministry of Environment and Sustainable Development to other actors. This observation seems surprising, as one would expect these two organisations to be at the centre of the information flows of the network.
Information flows from national to local level are more scarce and seem to be channelled through the "Mouvement pour Autosuffisance Alimentaire" (a Mauritian food security NGO), the Mauritius Agricultural Marketing Cooperative Federation Ltd. and other Cooperatives. Information to the local farmers associations is channelled through the Cooperatives but appears to be limited. Additionally, information is also barely shared between the research organisations and the local actors (e.g. farmers) directly; some information trickles down to local NGOs but little reach local farmers associations and Cooperatives.

Funding from international donors is mainly channelled through the Ministry of Finance and Economic Empowerment. This Ministry also distributes funding to other national actors, such as other national ministries (e.g. Ministry of Agro-Industry and Food Security, the Ministry of Environment and Sustainable Development) and to national-level organisations such as the Food and Agricultural Research Council, Mauritius Ile Durable, Mauritius Research Council. The Ministry of Agro-Industry and Food Security provides funding to the Mauritius Research Council. The Mauritius Research Council also gives funding to other national research organisations such as the Faculty of Agriculture of the University of Mauritius and the Mauritius Sugar Industry Research Institute.

At local level, funding to local NGOs and Farmers associations comes from the Ministry of Agro-Industry and Food Security. Local cooperatives receive some funding from the Mauritius Sugar Industry Research Institute. The Small Grant Program of the UNEP-GEF funds directly local organisations such as the "Mouvement pour Autosuffisance Alimentaire" and the Mauritius Agricultural Marketing Cooperative Federation Ltd.
Apart from a few exceptions highlighted above, funding for adaptation actions seems to stay mainly concentrated at national level for research (different research institutions) and policy-making and implementation (e.g. Maurice Ile Durable).

The line of action is initiated from the national level and originates mainly from the Ministry of Finance and Economic Empowerment and then the Ministry of Ministry of Agro-Industry and Food Security and the Climate Change Division of the Ministry of Environment and Sustainable Development (MoESD). The line of action then trickles to the local level through first the Small Farmers Welfare Fund (SFWF) and then to Local NGOs, the Mouvement pour Autosuffisance Alimentaire, Cooperatives and the Mauritius Agricultural Marketing Cooperative Federation Ltd. Local farmers are not linked to the line of actions, which stops at local NGOs and Cooperatives level.

For this group, the principal barrier of implementation of adaptation actions at local level was identified as "Lack of knowledge, evidence and access to data related to climate change vulnerability impacts and resources to plan adaptation options at national and local level". The group chose one pre-defined cause: "Perceptions of uncertain scientific data and projected impacts, conflicting data resulting in lack of decision-making" and also came up with their own cause for this barrier: " Lack or expertise and resources for strategic and coordinated approach for long-term adaptation planning". Controlling this barrier, were found to be national ministries, research organisations and finance service bodies.

To overcome the barrier identified, the group prioritised the practical actions: "Assess the information and expertise gap", "Strengthen the capacity across all sectors" and "develop a climate change data centre". The group chose a national actor, the Government, to initiate these actions.

Fisheries sector

This group working on the fisheries sector gathered representatives from organisations at national level (e.g. Ministry of Environment and Sustainable Development, Mauritius Oceanography Institute) as well as local level (e.g. Mauritius Fishermen Cooperative Federation Ltd). One participant representing the Mauritius Tourism Authority was also present at the workshop and joined this activity group.

On the stakeholder map drawn by the participants in this group, the actors with the most connections are the Ministry of Finance and Economic Empowerment, the National Disaster Committee and the Fishermen community. Found to have high influence over the implementation of adaptation actions at local level are not only the ministries and other actors at international (e.g. International donor agencies) and at national level (e.g. Ministry of Finance and Economic Empowerment, Ministry of Local Government (beach authority), Meteorological Services, National Disaster Committee, Ministry of Environment and Sustainable Development) but also actors at local level (e.g. Local Police, local offices of the National Coast Guards, local

fisheries protection services, local fishermen community). Of lesser influence on the implementation of adaptation action at local level are national actors (e.g. Mauritius Oceanography Institute, Ministry of Fisheries, Ministry of Telecommunication, Ministry of Social Security and National Solidarity and Reform Institutions, Ministry of Tourism, Ministry of Trade and Shipping, Fishermen Welfare Fund, Fishermen Investment Trust) and local actors (e.g. Local Authorities, Beach users, Coastal Communities. Additionally, the Fishermen Communities are found to have a higher influence than the Ministry of Fisheries and the Local Authorities and participants noted that the media had no influence but recognised its role in receiving and disseminating information from and to different actors.

The National Disaster Committee is at the centre of the information flow; It both gives and receives information from different actors. At national level, there is a good exchange of information between the different ministries, the National Disaster Committee, the Met Services and the Mauritius Oceanography Institute. From the national to the local level, the information seems to be cascaded down through the local offices of the National Coast Guards, the Local Police and the Media. At local level, local actors appear to share information widely: local offices of the National Coast Guards share information with local beach users, the Local Police, Coastal Communities, Local Authorities, Fishermen Communities and the Local Authorities and the Fishermen Communities also exchange information. The flows of information appear to be well-developed at national and local levels but only a few actors are making the link between the two: these are the local offices of the National Coast Guards, the Local Police and the Media. Of these three actors the local office of the National Coast Guards and the Local Police were found to have a high influence over the implementation of adaptation actions at local level whereas the Media had no influence at all. Also, the participants did not highlight any direct information link from national ministries to local authorities.

Funding flows from international donors to national-level ministries and organisations. At the centre of the funding flows, lie the Ministry of Finance and Economic Empowerment. This ministry distributes funding to national ministries and national organisations (e.g. Ministry of Fisheries, Ministry of Environment and Sustainable Development, Ministry of Social Security and National Solidarity and Reform Institutions, Meteorological Office, Mauritius Oceanography Institute) but also directly to local-level actors (e.g. Local Authorities, local offices of the National Coast Guards, Local Police, the Fisheries Protection Services). The Ministry of Social Security and National Solidarity and Reform Institutions channels funding to the Fishermen communities.

The National Disaster Committee initiates the line of actions from the national level. The line of action then goes directly to the local level without involving any other national ministries or national-level organisations. At local level, the line of command first reaches the local offices of the National Coast Guards and the Local Police and then is flowing to the Fisherman Communities and Beach Users.

The principal barrier of implementation of adaptation actions at local level identified by this group is the “Lack of accountability in the process of implementing adaptation options”. The underlying causes for this barrier are “Absence of strategic and coordinated approach to funding adaptation priorities”, “No guidance from other levels of government which is flexible enough to allow the community to use judgment and apply local knowledge, but rigorous enough to provide back-up and

support to decision makers", "Lack of direct contact between Federal and Local Governments", "Short term planning, absence of long term national development implementation, vision plan and implementation plan" , "Pressures from developers and other tiers of government" and "Lack of willingness to make tough decisions".

To overcome the barrier identified, the group prioritised the practical action: "Create a sense of ownership and instil a sense of responsibility". To implement this practical action the same actors who are responsible for the barrier and who can lift it would be responsible to implement it, namely the National Disaster Committee, the Ministry of Finance and Economic Empowerment, the Ministry of Environment and Sustainable Development, the Meteorological Services and the Mauritius Oceanographic institute.

Discussion

Both networks have discrepancies and similarities. In terms of the information flows from national to local levels, the agriculture network presents a rather isolated local Farmer Communities and Local Actors, where information is scarce but the fisheries network depict a different picture, one where the Fisheries Communities are well-connected for information. In the agriculture sector, the group mentioned that an exchange of information should happen between 3 types of actors: the Government, the beneficiaries and the research and support services. It is interesting to note the inclusion of the beneficiaries, (i.e. local farmers) in the equation as so far they were not really included in the process as they were depicted as not exchanging information with any other actor in the network. This observation shows a recognition and an awareness from the participants that local farmers are left out and need to be reached out to and included.

In terms of funding, International Donor Organisations are consistently identified as the main sources of funding for adaptation in the two sectors. The funding from international sources is mainly directed to the Ministry of Finance and Economic Empowerment, which then re-directs funding mainly to national-level ministries and organisations. In the agriculture sector, apart from a few exceptions highlighted above, funding for adaptation actions seems to stay mainly concentrated at national level for research and policy-making and implementation (e.g. Maurice Ile Durable). In the fisheries sector, funding seems to flow a bit better to local level organisations and communities.

The line of action is initiated from the national level in both sectors and then trickles down to the local level. For the agriculture sector, the line of action stops at local NGOs and was not represented as reaching local farmers. On the other hand the line of action in the fisheries sector seems to go all the way to the Fisherman Communities and Beach Users.

Although the adaptation barrier identified for both sectors are different they both highlight the importance attached to the role of national-level organisations in tackling the barrier identified. This illustrates the still predominant role of national-level organisations in driving the planning and implementation of adaptation actions.

The barrier identified in the agriculture network is linked to knowledge around data related to climate change ("Lack of knowledge, evidence and access to data related

to climate change vulnerability impacts and resources to plan adaptation options at national and local level") and the barrier from the fisheries network is institutional ("Lack of accountability in the process of implementing adaptation options").

The former barrier could be tackled without delay by implementing the practical actions identified by the group: "Assess the information and expertise gap", "Strengthen the capacity across all sectors" and "Develop a climate change data centre". Rather than the Government, chosen by the participants as the actor to initiate these actions, the Meteorological Services could be responsible for taking some of these forward. Its capacity could be strengthened and the exchange of information from this organisation to national and local level organisations could be encouraged. It is important to emphasise that most of the barriers are surmountable, i.e. they can be addressed using existing capacities within the island without requiring the support of external consulting advice. Practical solutions to overcome the barriers are not always complicated and nor should they always call for the assistance of capacities out of the island.

The second barrier identified however is more deeply-rooted into the institutional setting of the island. It will therefore be more difficult and take longer to address. But such barriers can be addressed subsequently, as starting with the "easy wins" should be prioritised.

Participants drawing the networks and their different flows found the exercise very useful. But rarely do they get together to discuss issues around climate variability and change and adaptation actions to these; one of the main feedback of the workshop was how much they appreciated to have had the opportunity to be brought together. The methodology developed for the workshop is easily reproducible and do not require a high level of expertise in climate change or climate adaptation. It also provides a structured way to get the participants to interact with each other, identify potential barriers and devise possible practical actions to overcome these barriers. Workshop participants were able not only to identify barriers but also come up with implementable solutions. This demonstrates that participants had a real commitment in building consensus to address specific issues in these islands.

The key message is that some of the barriers identified can already be overcome by looking at the consensus solutions proposed by the participants during the workshop and thinking about implementing them within the capacity and governance structure of these islands. Involving national and local stakeholders into overcoming these barriers will contribute to develop communities of practice on adaptation in Mauritius. This second step has not so far been implemented but would be very interesting to follow-up with.

Conclusion and future research

National governments do play a crucial role in the governance of adaptation as they are seen as key actors that can intervene and confront existing barriers by changing policies or providing additional resources (Ford and Pearce, 2010, Measham et al., 2011). But they are also reported to constrain local bottom-up initiatives on adaptation (Amundsen et al., 2010, McNeeley, 2012).

The participatory identification of adaptation barrier and how to overcome them could be a successful planning process that reconciles national adaptation policies with the implementation of local adaptation actions. It involves the different stakeholders in devising solutions that not only are in the line with national adaptation policies but also are a step towards reducing vulnerability against climate extremes at local level. Prioritising the identified barriers that are surmountable and that can already be addressed within the islands' capacities would be the beginning of building climate resilience at national and local level.

The majority of studies on barriers use small and inductive case approaches while comparative studies across different contexts are limited. Applying the methodology outlined here to further case studies, beyond the 4 SIDS covered in the GIVRAPD project might reduce this gap and build on the existing knowledge pool.

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