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An assessment of community-based adaptation initiatives in the Pacific Islands

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Abstract

Community-based adaptation, in principle, leverages existing local knowledge, capabilities, and priorities. Although there is an increase in adaptation activities in the Pacific region, it remains uncertain whether these are effectively promoting long-term adaptive capacity. Here we evaluate the performance of 32 community-based adaptation initiatives across 20 rural communities in the Pacific Islands. We find that initiative appropriateness was a strength while sustainability was a consistent issue; locally-funded initiatives and those implemented by non-governmental organisations were more likely to perform better; climate-awareness raising initiatives and those integrated with ecosystem-based adaptation performed best. We also identify four interdependent optimization points for future community-based adaptation initiatives: local approval and ownership; shared access to and benefit from initiatives; integration of local realities; and systems-thinking and forward planning. Our analysis suggests a need for a praxis shift whereby adaptation is locally-led, communities drive their own agendas, and donors and implementers become facilitators that resource the diverse capacities of communities.

The Pacific Islands are highly vulnerable to climate change impacts, despite having contributed little to its causes¹. With projections showing that island communities will continue to face worsening climate change impacts over the remainder of this century and beyond, understanding what successful adaptation looks like for the Pacific Islands is urgent^{2,3}. Significant donor-funded adaptation investment means efforts have already been carried out, with the Pacific receiving the highest per capita climate aid globally², a focus likely to be maintained at least in the short term³.

With growing understanding of diminishing returns resulting from top-down climate change responses, assistance is increasingly being delivered at the local scale through bottom-up responses such as community-based adaptation (CBA)^{4,5}. CBA is an approach that is small-scale, place-based and grassroots driven, while also having synergies with broader development aspirations⁶. In principle, the local scale focus of CBA provides an opportunity for adaptation to better acknowledge and integrate existing local knowledge, capabilities, priorities and context of the community, and for impacts to be addressed at the scale at which they are experienced^{7,8}. Effective and sustainable adaptation that fosters reflective engagement with the community (i.e. ideal CBA)⁹, however, is not as straightforward as often implied¹⁰. Negative impacts can occur if CBA fails to adequately represent vulnerable populations and generate long-term social resilience^{11,12}.

Despite the increasing number of CBA activities across the Pacific region, uncertainty remains around whether these communities are becoming better prepared to cope in the long-term^{13,14}. Bottom-up approaches such as CBA are important in Pacific Islands as they can support and utilize traditional governance systems to help mobilize resources, better use traditional knowledge, and inform or support the management of sustainable adaptation^{15,16}. Further, the complementarity that bottom-up approaches often exhibit with cultural norms and connections to land and place in most Pacific Islands is critical for socio-ecological resilience and influencing behaviour¹⁷. Good practice for bottom-up approaches like CBA must therefore be further developed and shared as a matter of urgency^{7,18}.

High performance adaptation stories are championed to ensure they can be scaled up and out in future programs while stories of adaptation requiring significant work and improvement are rarely reported or exploited as a source of learning¹⁹. This is regrettable because these lessons are as salient as success stories for optimizing CBA, which continues to receive extensive funding despite the paucity of information and evidence for its success^{20,21}. Previous studies that have evaluated CBA have largely been context-specific case studies^{18,20,22,23,24} offering in-depth insights in specific locations and for particular CBA initiatives but not always providing transferable learnings (although exceptions do exist^{25,26}). Further,

adaptation research in Small Island Developing States (SIDS) tends to focus on core or near-core areas of a country rather than rural, peripheral areas that are more difficult to access^{27,28}. By undertaking site evaluations on the success of CBA in increasing adaptive capacity across rural communities in the Pacific, this study tracks progress at a larger scale and addresses these shortcomings.

To evaluate CBA progress, we explore local perspectives and embedded experiences of rural community members across four Pacific Island nations: Fiji, Federated States of Micronesia (FSM), Kiribati and Vanuatu. While the selection of these island nations to some extent reflected researchers' existing networks, it was intentional in that it included one atoll nation (Kiribati), one mixed atoll and high-island nation (FSM), and two high-island countries (Fiji and Vanuatu) with contrasting economic rankings, in order to sample a representative range of contexts among Pacific SIDS. Within each island nation, rural communities were sampled along core-periphery gradients to capture differences in adaptation contexts, as earlier work shows exist^{27,29,30}. In Pacific SIDS, most rural communities are largely subsistence-based, occupying land to which they have title and have done so for generations, and engage in livelihoods that are at least partly culturally-grounded²⁹. While there are variations in the nature of such rural communities attributable to peripherality^{29,30}, their commonalities dominate, making site selection for this study more straightforward than elsewhere.

There is no consensus on, and a lot of ambiguity around, what 'successful' adaptation is and how to measure it^{31,32}. Based on a review of literature about what constitutes 'successful' adaptation, five key evaluation components were deemed appropriate for this study: appropriateness, effectiveness, equity, impact and sustainability (see Table 1 for definitions). This study is based on participant perspectives of CBA performance considering each of these components, derived from 415 participants in 44 focus groups and 62 in-depth interviews between April 2017 and July 2019 (see Methods). Thus, it relies on embedded and subjective experiences of participants involved. Understanding how individuals and communities perceive their own adaptation experiences is critical as cognitive aspects (e.g. perceived self-capacity) are crucial to adaptation intention, community-buy-in and adaptive capacity^{33,34,35}. Further, measuring perspectives of individuals towards their own situation allows for more meaningful comparisons within contexts and through time³⁶. Comparisons through time are critical as this is a process-based assessment in that it is too early to accurately determine whether long-term adaptive capacity and vulnerability reduction will be achieved (even by initiatives perceived as high performing at the time of this study). Although this study still provides valuable insights, there remains a need for on-going monitoring and evaluation to assess long-term impacts.

CBA in rural communities across the Pacific

Twenty rural communities participated in this study which gave rise to 14 case study sites as some sites included multiple communities of place (i.e. based on ties to a physical space³⁷) that were involved simultaneously in the same initiatives. Exemplifying the miscellany of adaptive responses, this study evaluated 32 diverse CBA initiatives related to enhancing food security (n= 9) and enhancing water security (n= 8) or both simultaneously (n= 1), prevention of land loss (n= 5), relocation (n= 3), climate change awareness-raising (n= 2), marine resources protection (n= 2), and enhancing financial security (n= 2). Table 2 provides a summary of case study sites and CBA initiatives. Supplementary Table 1 describes the intended contributions to adaptive capacity of each CBA initiative type.

These initiatives are not each stand-alone projects but rather sub-set initiatives that can be aggregated into 15 overarching, broader projects. This paper is structured around sub-set initiatives rather than broader projects to capture the diverse experiences and outcomes that emerged for local participants, even within a single project. These initiatives were funded through eight different funding bodies (three international donors and five local sources) and implemented by thirteen different agencies (nine government-related institutions/departments, three non-government organisations (NGO) and one local university), some of which partnered to fund or implement initiatives jointly.

Overall initiative performance

We found that initiatives generally performed well in terms of appropriateness while sustainability required significant improvement across almost all (see Extended Data 1). Some initiatives had high performance across all components of adaptation success except sustainability, highlighting how even when other components performed well, sustainability can be the most difficult to achieve because it needs to stand the test of time. If initiatives have poor future planning, then the sustainability of initiatives is often limited. Based on participant perspectives on CBA performance for the five components, evaluated initiatives were placed along a scale from high to low performance (Figure 1, based on Extended Data 1).

Although there were no particularly strong patterns in terms of the spread of variables across the scale (and thus no particularly strong influences from the variables on initiative performance), there were some noteworthy patterns. Locally funded initiatives were, for example, proportionately more evident amongst high and medium performing initiatives. Although internationally funded initiatives had a more even spread across the scale, they dominated the low performing category due to locally funded initiatives performing proportionately higher. Similarly, initiatives implemented by NGOs (whether with local or

international funding) were proportionately more present within high and medium performing groups while those implemented by governments had a more balanced spread across the scale and universities were largely medium performing. Marine resources protection and climate-awareness initiatives also tended to have higher performances than others, while initiatives focused on preventing land loss had low performances overall. There was a largely scattered spread of the relevant country on the scale, except for FSM that had proportionately more high and medium performing initiatives. Through latent content analysis, we also found that a series of factors related to initiative design and implementation shaped the performance of initiatives; these common characteristics are discussed in detail below and summarized in Tables 3-5.

High performing initiatives

Initiatives with high performance had several attributes in common (Table 3), one of which was the effective production of outputs linked directly to adaptive capacity. Improvements in awareness and knowledge, for example, enhanced abilities of community members to understand experienced changes, thereby supporting disaster preparedness and enhancing perceived capacities to cope: “The awareness [sessions] are one thing that we learn a lot [from]... it’s [be]coming clear that, yes, our weather is changing” (Vanuatu, personal communication, 2017). Many initiatives also proved appropriate to local context by being tailored to cultural specificities as well as community livelihoods, resources and priorities. In several cases, this nurtured a sense of local approval and positive sentiments around initiative sustainability. It is important to note, however, that despite many of these high performing initiatives achieving local approval and appropriateness, the tendency to be top-down in nature remained by being largely designed and implemented by external actors (rather than grassroots-driven as in ‘ideal’ CBA). The climate-awareness raising initiatives appeared to be somewhat co-designed and driven by local communities with participatory presentations from local community members.

Another commonality among high performing initiatives was the tendency to move away from archetypal parameters of a ‘community’ which are usually based on ties to physical space. These approaches enhanced the equity of initiatives by minimizing internal disputes and having more widespread benefit (e.g. by being open to community members across an island or through encouraging information/skill transfers beyond those directly involved). This is not to say that initiatives based on geographic boundaries proved incapable of equity. The success of climate change awareness-raising initiatives (V4b, V5a), for example, was partly dependent on equitable modes of information transfer and delivery for those with low literacy and disabilities (e.g. use of a projector for animations, pictures and presentations).

Several initiatives were also able to simultaneously address climatic and non-climatic pressures or issues for rural livelihoods, thereby supporting an overall reduction in vulnerability across a relevant system (systems-thinking) and, in one case, fostering a sense of local approval and satisfaction. The positive sentiments that can emanate from this characteristic are exemplified by the following statement related to an initiative that simultaneously addressed non-climatic concerns related to housing (F2): “We were very happy with the relocation... it solved the problem where there was three, four generations [crowded] in one house [in the old village]” (Fiji, personal communication, 2017).

The two top-performing initiatives were similar in their integrated approach where, although focused on a community scale, were also based on the protection of a local ecosystem which leads to ecosystem-based adaptation (EbA). Through this integration, these initiatives simultaneously occasioned several of the aforementioned common characteristics: appropriateness to local context (i.e. based on ecosystems critical to rural livelihoods); moving away from geographical parameters (i.e. basing the ‘community’ around those that use the ecosystem); and simultaneously responding to livelihood pressures that are not directly climate-linked (e.g. income and food security).

Although these are high performing initiatives, several issues arose. Poor sustainability, for example, emerged and was largely due to poor future planning, where “no-one factored in the future” (FSM, personal communication, 2018), especially in terms of trends in climate change and population growth. The tendency for some short-term benefit but poor long-term impact is depicted by one woman: “Water tanks have helped but there isn’t enough for anything except cooking and drinking – we are still bathing in saltwater... drought sees the water source dry up and the tank empty” (FSM, personal communication, 2018).

Other issues that arose were more specific to certain initiatives and included delays in implementation processes which engendered community resentment and disapproval (F5), the need for regular reinforcement of infrastructure (V2d), and some issues with equity and access to decision-making. The nature of the first issue further demonstrates how CBA tends to be top-down rather than grassroots driven. In terms of the latter, one relocation project, for example (F2), performed lower than the other (F5) as it had a less equitable decision-making process for women. Positive aspects, however, outweighed these characteristics, resulting in these initiatives being perceived as high performing.

Medium performing initiatives

Medium performing initiatives were perceived as having mixed positive and negative aspects. Some key characteristics (Table 4) echo those discussed above. First, the importance of producing outputs is re-emphasized here as one initiative demonstrated how inadequate generation of outputs impedes community motivation to maintain activities (i.e. will return to traditional ways) (V4a). Second, the importance of simultaneously catering to climatic and non-climatic livelihood pressures is negatively reinforced in one initiative that lacked a systems-thinking approach, meaning that other sources of vulnerability were overlooked. This impeded initiative effectiveness and sustainability (V5c): “with the continuous disaster of the [nearby active] volcano... it’s hard to achieve the [adaptation] goals” (Vanuatu, personal communication, 2017). Parallel hazards (e.g. ash fall destroying climate-resilient crops and equipment provided by the project) can perpetuate vulnerability in the system regardless of climate scenario.

Most medium performing initiatives tended to be appropriate to local context in terms of community priorities. Three initiatives, however, demonstrated how adaptation can be appropriate in terms of catering to priorities while having other contextual applicability issues (K1, V5b, V5c). These initiatives only partly integrated contextual aspects by focusing on the broad livelihood priorities but relying on external resources (V5b, V5c) or overlooking more specific yet related needs such as improved market access and water for irrigation (i.e. the wider vulnerability context) (K1). These generated issues for sustainability as external resources were difficult to replace for maintenance (V4b, V5c) and crops did not grow well (K1): “The biggest failure is the provision of the water. They said they would provide water that would spray the plants but they didn’t, so most of the crops die” (Kiribati, personal communication, 2017). In Kiribati, this also occasioned stress related to having another failed project, increasing community skepticism about externally-sponsored adaptation projects. These kinds of issues point to the tendency for these initiatives to be designed and implemented by external actors, rather than being grassroots driven.

In terms of equity, there was a nearly equal number of initiatives that had high performance and those which had issues. Several initiatives in FSM were perceived more generally by all community members to be equitable in terms of members being informed and consulted (FSM1a, FSM1b, FSM1c), a likely result of significant outreach work on equity by NGOs but also the existence of matriarchal lineages which ensures decision-making around cultural, political and social community dynamics is largely gender-neutral. A more specific but common characteristic to note was the ability of some initiatives (V4a, V5b,

V5c) to advance women's empowerment and gender equity. As one female participant stated, "At first, I was shy and scared of talking but when [implementing agency] did more activities and training and involved us, this is where I started to build up confidence and become involved... I began to speak up for myself" (Vanuatu, personal communication, 2017).

Initiatives with poor equity and exclusive tendencies in this group were largely a result of overlooking social and/or cultural considerations and dynamics. Two initiatives (V2g, V4a), for example, did not implement appropriate 'community' parameters for the cultural context and social dynamics, thereby giving rise to exclusion. One initiative (V2g) which merged two villages as one 'community' (for project purposes), for example, gave rise to internal disputes that resulted in one village being excluded: "it [initiative] was working for a couple of months [but] is now only serving the other community... we're all related, both villages, but they're a bit strong-headed" (Vanuatu, personal communication, 2018). One participant (from V4a) suggested that by establishing 'community' parameters on social characteristic boundaries, such as gender or religion rather than geography, initiatives may have been more equitable. This reiterates the aforementioned potential for different 'community' parameters to be more equitable and have more impact, but also highlights how the nature of the actions have been shaped by what may be more convenient and suitable for external actors. Local communities were not been involved in designing and shaping the initiative to what may be most suitable to them and their local contextual factors, especially in terms of social and cultural considerations and/or dynamics when delineating 'community' boundaries. It is important to also note here that V4a illustrates how holistic equity is hard to achieve: although there was exclusion of a religious group, there were also progressions in gender equity and women's empowerment for those involved.

Utilizing the appropriate 'community' parameters to have more impact is not always enough on its own. We found performance varied between initiatives that were all implemented through a district training center as an atypical 'community'. Two initiatives (V1b, V1c) were ranked lower than V1a (high performing initiative) and this was largely because the former required ongoing inputs and upkeep, which became difficult when the leader of the training center changed. Further, a drought and concomitant lack of water rendered the fish farm (V1c) difficult to maintain, connoting limited contextual appropriateness.

Despite initiatives being appropriate to local priorities (e.g. FSM1a, FSM3c) or effective in the short-term (e.g. FSM1b, FSM1c, V5b), several initiatives were not designed in ways (due to being designed by external actors) to promote and empower the self-sufficiency of communities and their abilities or motivations to sustain initiatives beyond project lifespans (i.e. when funding ceased). This included the poor integration

of local and available resources which made it difficult to source and replace equipment parts as well as poor design elements which rendered maintenance more difficult than necessary. In terms of the former, one participant asserted that it would “be better if you could take something that is already inside of the community and use that” (Vanuatu, personal communication, 2017). Promoting community self-sufficiency is critical for better forward planning and initiative sustainability.

Similarly, although F3 (as the lowest performing relocation initiative) was initially approved by the local community, poor design elements hampered local approval and affected perceptions around the long-term viability of the new site. These mixed feelings are exemplified in this quote: “We were delighted with the move to the new houses, but we are still worried about the landslide because the houses are on the hill” (Fiji, personal communication, 2017).

Low performing initiatives

Low performing initiatives represent initiatives that local communities perceived as having more issues than not, albeit most still being appropriate to local context in terms of community priorities and aspirations. Among these initiatives, some characteristics emerged (Table 5) that reiterate key findings presented above. Low performing initiatives, for example, further underscore the problem with overlooking future trends as several initiatives became ineffective because of poor planning around, and consideration for, future climatic changes. Two initiatives also illustrate the importance of integrating local resources and/or community self-sufficiency for sustainability: V2e had unmaintainable high costs which rendered the community unable to achieve self-sufficiency; and V3b had a heavy reliance on external resources (e.g. expertise and construction material) so that when difficulties emerged, there was a lack of local technical capacity and funds to sustain the initiative. One community member stated: “we should use local experience in design because we know the context... instead of getting someone to come in and then it doesn’t work” (Vanuatu, personal communication, 2018). Utilizing existing labor and skills (a local resource) is, therefore, critical for forward planning. This again demonstrates the top-down nature of CBA, where initiatives are being designed and implemented by external actors with external resources rather than driven by the community and their situated resources (as in ideal CBA).

Initiatives focused on preventing land loss generally had low performance, especially in the long-term, and this stems largely from the tendency to sideline local approval and/or ownership through a top-down approach with little to none community input. Reasons include the lack of genuine ownership of the initiative by the community, poor alignment with contextual factors (including perceived climate risk and community desires), and maladaptive outcomes, or a combination of these. One initiative (F1)

demonstrated how a lack of forward planning (overlooking future intensification of climate impacts) resulted in maladaptation, thereby creating new vulnerabilities for the community: it became “a liability to our children’s safety, it damages our nets [and] our livelihoods are being affected” (Fiji, personal communication, 2017). This then led to community disapproval.

It is not, however, solely prevention of land loss initiatives which lacked local approval and/or ownership due to being designed and driven by external actors rather than the community. The lowest performing initiative (V2f), for example, also overlooked contextual factors and community desires which generated local disapproval and poor ownership: the “idea was not welcome” and “people were not comfortable” (Vanuatu, personal communication, 2018). The community consequently lacked any motivation to maintain the initiative long-term and there was no desire to implement similar initiatives in the future.

Poor consultation and communication with communities and other stakeholders (as attributes that again lend to a top-down nature and not CBA principles) was also a key contributing factor to poor performance. Some initiatives (F4, V2f), for example, had poor alignment with contextual realities by being imposed from government or implementing agency and involving inadequate consultation.

Four interdependent points for optimization

Analysis of the characteristics of high, medium and low performing initiatives suggest four points required for optimizing future CBA. Across our sample, these optimization points, which are multi-dimensional and interdependent in nature, were both negatively and positively reinforced as key factors supporting initiative success.

Local approval and ownership

The importance of local approval and ownership encourages higher levels of participation⁷ and ensures activities are not resisted but sustained beyond the end of the (funded) project^{24,38}. Factors that contributed to local approval and ownership included the ability of initiatives to protect livelihoods, responding to direct requests from communities, appropriateness to local realities and producing benefits beyond reducing exposure to climate risk in the system (i.e. addressing other critical livelihood pressures simultaneously). The latter two demonstrate the interdependencies between optimization points and how they can influence each other. In particular, the importance of local legitimacy through fabrication around local realities (e.g. integration of local context, priorities, resources and knowledge) for fostering community support and participation has been noted elsewhere^{7,17,24}. The top-performing marine resources protection initiatives (integrated CBA-EbA initiatives), for example, fostered local

approval by being based on, and appropriate to, ecosystems that are critical and relevant to the livelihoods of rural communities. Systems-thinking, in which the wider vulnerability context is recognized³³, can similarly enthrust local approval and ownership over initiatives by simultaneously catering to the community's other pressing livelihood concerns and baseline aspirations that are not climatic (thereby being 'pro-poor'^{24,39}). We found that some low performing initiatives did not acquire genuine local approval and ownership because of a range of issues related to the tendency for initiatives to still be top-down in nature: inadequate consultation, attempts to 'buy' ownership, maladaptation and indifferent alignment with contextual realities. In several cases, this resulted in initiative demise after funding ceased, thereby negatively reinforcing the importance of this optimization point and demonstrating how fostering local approval and genuine ownership is critical to sustainability and forward planning (as another optimization point)^{24,38}.

Shared access to and benefit from initiatives

CBA that challenges entrenched intra-community inequalities and supports shared access to, and benefit from, initiatives are critical for sustainability^{3,40}. In this study, shared CBA was characterized by (what participants perceived to be) effective and adequate consultation with all community members, the focus on an ecosystem (as part of CBA-EbA integration) that can benefit and is accessible to all as well as improvements in gender equality in decision-making. The latter is crucial as social transformations have been emphasized as critical to CBA²⁵ and gender-based exclusion was a key challenge that emerged within CBA literature^{4,7,23,24,41}. Another important consideration that emerged here was the need to reconsider the geographic scale of 'community' as the most appropriate entry point for shared and equitable adaptation. This is because alternative scales may be critical for building social capital and optimizing shared access and/or benefit (e.g. approaches based on landscape, 'whole-of-island', ecosystems, local institutions or particular population groups)^{42,43}. Basing initiatives on geographic community parameters (which was most common) occasionally excluded certain groups and/or inflamed internal disputes. This reminds us of the elusiveness of 'communities' and how the 'framing' of a 'community' imposed by implementing agencies may not equally benefit intended participants^{42,43}, likely due to uncritical assumptions about homogeneity^{4,30,40}. 'Community' boundaries and scales should be understood as complex and contextually dependent^{24,40}. External actors must strive for CBA that is designed and driven by the local community as this would ensure it is communities themselves that delineate their own 'communities' based on nuanced social/cultural dynamics and other contextual factors (thereby integrating local realities as another optimization point). This could help avoid the observed internal disputes and exclusions or marginalization in this study, although external actors should

be wary of and be prepared to help communities address any other entrenched inequalities within the chosen 'communities'.

Integration of local realities

Integrating local realities and existing social forms improves the likelihood of success for community-based initiatives^{7,25,44}. In this study, as found elsewhere⁷, compatibility with local context in terms of culture, priorities, resources and livelihoods ensured that activities were not resisted and thereby sustainable. The importance of this optimization point was also negatively reinforced by the use of non-local resources in initiatives which, regardless of any local approval or ownership, generated difficulties for long-term maintenance and sustainability (i.e. forward planning, as discussed below). Undue dependence on external resources has previously been noted as unsustainable and potentially harmful to livelihood futures in such contexts³. Further, overlooking contextual realities more generally can also result in poor ownership, outcomes and sustainability as initiatives may not adequately integrate local processes or be appropriate to key livelihood risks or concerns (e.g. constructing a river wall when a sea wall was needed). Local knowledge is thereby critical here as it ensures a better understanding of local processes in the system¹⁵. These kinds of issues underscore the importance of having adaptation that is wholly driven by the community rather than external implementers who may overlook these contextual nuances and situated resources. In sum, this optimization point cross-cuts all other optimization points by playing a crucial role in ensuring local legitimacy and concomitant community approval and ownership^{7,24}, supporting shared adaptation in terms of benefit and access (e.g. by ensuring a better understanding of social dynamics and appropriate community 'parameters') as well as being critical to forward planning and heightening the likelihood of initiatives being sustained (e.g. by integrating local resources).

Relevant here is the higher performance among locally-funded initiatives compared to those funded internationally. This may be because locally-funded initiatives are more likely to be designed and driven by people familiar with local contexts and sociocultural nuances, as opposed to outsiders who may have prescriptive funding conditions⁴³ and set the agenda of (ineffective and unsustainable) work^{45,46}. This is still, however, one step away from being driven by the communities themselves.

Systems-thinking and forward planning

The last optimization point describes the ability of initiatives to have impacts beyond project aims, particularly in terms of addressing vulnerabilities across the relevant system and having long-term impacts (involving changes to accustomed practice). It became evident that bypassing a system approach in which dynamic pressures are viewed as part of a larger, interrelated system or context^{47,48}, can

contribute to ineffectiveness and unsustainability. One case study site, for example, demonstrated how overlooking parallel sources of vulnerability in adaptation can perpetuate overall vulnerability irrespective of climate scenario, because rural livelihoods are challenged by multiple dynamic pressures that create vulnerability⁴⁹.

Other initiatives positively reinforced this optimization point by producing development-related benefits that were beyond climate-related aims, thereby actualizing a key attribute of 'ideal CBA' (i.e. a 'no-regrets' approach embedded within broader development goals^{6,39,50}). A key characteristic that contributed to the high performance of the two top-performing integrated CBA-EbA initiatives, for example, was the abatement of environmental degradation which then minimized indirect negative socio-economic impacts (e.g. in terms of finance and food security) from climate change. The capacity for EbA-CBA integration to combine adaptation and sustainable development has been recognized elsewhere^{51,52}. This is critical as most adaptation-related needs may not be directly related to climate but involve laying the foundations for empowering individuals and communities to pursue the adaptation outcomes that they value (e.g. through developing capabilities)³⁶. Basing adaptation on local context, priorities and knowledge will ensure that the most critical adaptation-related needs in a specific context are addressed. In sum, there is a greater need for systems-thinking approaches to ensure that externalities are foreseen, adaptation is delivered in a way that encourages recipients to act on their own³³, and that activities are sustainable⁴⁷.

Having impact over time emerged as a key weakness. Several initiatives focused too closely on present-day conditions and hazards which, although often effectively reduced short-term vulnerability, overlooked the potential for change. This tendency to apply adaptation to everyday climate-related challenges rather than future issues is a problem recognized across most documented adaptation in SIDS²⁸. These initiatives were not 'future-proofed' to deal with the dynamism of vulnerability and enhance long-term resilience⁵³, thereby occasionally resulting in maladaptation. One initiative that had low performance in terms of forward planning involved the construction of sea walls. This highlights the maladaptive outcomes of infrastructural developments that sometimes unintentionally create trajectories which are path dependent and difficult to change⁵⁴. Having adaptation that is community driven and integrates local resources proved relevant and important here as the inability to replace or maintain non-local resources meant communities were not able to be self-sufficient in the long-term, especially after funding and external support ceased. Approaches that consider both present conditions and longer

timescales (forward planning) are critical⁵⁵ for building long-term resilience and for avoiding these short-term often maladaptive implications.

Discussion

We found mixed performance of CBA in 20 communities across four Pacific Island countries. While appropriateness was largely positive, sustainability was an area requiring significant improvement. Locally funded initiatives, those implemented by NGOs, those focused on climate-awareness raising and those integrated with EbA were also more likely to be high performing. The latter illustrates why CBA-EbA integration is often promoted^{52,57}. Collaborative learning between the two approaches may be critical for optimizing adaptation^{51,57}, especially in rural communities where livelihoods are inextricably linked to local ecosystems. Despite high performances among these initiatives at the time of this study, it is critical to remember that long-term improvements in adaptive capacity and vulnerability will become clearer over time.

Four multi-dimensional and interdependent optimization points were identified as key contents of the toolbox for improving future CBA. They also point to the need to rethink CBA as more than merely being 'based' in communities or having community 'consultation', but instead, as something that is wholly 'led' by local people and local institutions⁴³. This is critical as, despite genuine attempts to better integrate contextual specificities, initiatives across high to low performing groups demonstrated a tendency to still be top-down in nature. Despite being based in communities, initiatives tend to not be driven or co-designed by them. This gave rise to a range of issues which hindered CBA performance: community stress and resentment; initiatives having contextual applicability issues (e.g. relying on unsustainable external resources); initiatives being designed in ways that do not empower or promote community self-sufficiency; imposed 'community' boundaries; and local disapproval and lack of ownership.

Rather than experiments in communities to improve their adaptive capacity deficit, communities would, in community-led adaptation, build on their strengths and design/drive their own adaptation aspirations based on local knowledge, experiences and coping mechanisms. With communities leading their own adaptation agendas, numerous aspects of the optimization points would likely be autonomously incorporated: the most pressing climatic and non-climatic livelihood pressures in the relevant system would be equally prioritized and considered; context will be underpinned which means important resources, knowledge and contextual factors are will be more appropriately utilized; and a stronger sense of local approval and ownership will be fostered^{29,30}. These factors, in turn, support sustainability (as the

key area requiring improvement) as initiatives, being rooted in community aspirations and local context, will be self-sufficient over time. Further, a community-led approach may better ‘future-proof’s through the integration of local resources and local knowledge (e.g. in terms of observed trends in local population and climate) which were often overlooked. It is the role of implementers and donors to further resource and equip communities with any additional skills, resources and knowledge that may optimize self-sufficiency.

The role that implementers and donors should and can play is by becoming ‘facilitators’ or ‘co-designers’ of the desired adaptation aspirations for communities, rather than ‘doing’ adaptation ‘to communities’ under the guise of CBA. Through such a process, implementers would support and empower ‘communities’ in their diversity of expressions and guide them in certain processes (e.g. in supporting shared adaptation in terms of access and benefit or empowering women in leadership positions). Through local facilitators ‘guiding’ the resources and supporting participatory processes with holistically targeted equity framings, deeper understanding of any contextual idiosyncrasies related to inequality and power may overcome critiques of community-driven development⁵⁶.

Ultimately the role of implementers and donors is to prepare and support communities to lead their own adaptation because, as we have seen, implementers have left not long after the project has been implemented, and funding may ultimately dry up⁵⁸. Despite the supposed development deficit that is projected on them from outside, such communities have always been resilient and there is still much that the CBA field can learn from traditional governance systems and Indigenous knowledge¹⁵. Our findings suggest that it is time to support their diverse capacities and allow Pacific Islanders’ situated and tacit resources to flourish.

Reference List

1. Nurse, L.A., McLean, R.F., Agard, J., Briguglio, L.P., Duvat-Magnan, V., Pelesikoti, N., Tompkins, E., & Webb, A. in *Climate change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Contribution of Working Group ii to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* (eds V. Barros et al.) Ch. 29 (Cambridge University Press, 2014).
2. Betzold, C. Adapting to climate change in small island developing states. *An Interdisciplinary, International Journal Devoted to the Description, Causes and Implications of Climatic Change*, **133**, 481–489 (2015).
3. Nunn, P. & Kumar, R. Understanding climate-human interactions in Small Island Developing States (SIDS). *International Journal of Climate Change Strategies and Management*, **10**, 245–271 (2018).

4. Dodman, D. & Mitlin, D. Challenges for Community-based Adaptation: Discovering the Potential for Transformation. *Journal of International Development*, **25**, 640–659 (2013).
5. Reid, H. Ecosystem- and community-based adaptation: Learning from community-based natural resource management. *Climate and Development*, **8**, 4–9 (2016).
6. Schipper, E.L.F., Ayers, J., Reid, H., Huq, S. & Rahman, A. *Community-based Adaptation to Climate Change: Scaling it up* (Routledge, 2014).
7. Ensor, J. & Berger, R. *Understanding climate change adaptation: lessons from community-based approaches* (Practical Action Pub, 2009).
8. Kirkby, P., Williams, C. & Huq, S. Community-based adaptation (CBA): adding conceptual clarity to the approach, and establishing its principles and challenges. *Climate and Development*, **10**, 577–589 (2017).
9. Pelling, M. *Adaptation to climate change: From resilience to transformation* (Routledge, 2011).
10. Adger, W.N. & Barnett, J. Four reasons for concern about adaptation to climate change. *Environment and Planning*, **41**, 2800–2805 (2009).
11. Ensor, J. *Adaptation and Resilience in Vanuatu: Interpreting community perceptions of vulnerability, knowledge and power for community-based adaptation programming* (Oxfam Australia, 2015).
12. Taylor Aiken, G., Middlemiss, L., Sallu, S. & Hauxwell-Baldwin, R. Researching climate change and community in neoliberal contexts: an emerging critical approach. *Wiley Interdisciplinary Reviews: Climate Change*, **8**, e463 (2017).
13. Hay, J. & Mimura, N. Vulnerability, Risk and Adaptation Assessment Methods in the Pacific Islands Region: Past approaches, and considerations for the future. *Sustainability Science*, **8**, 391–405 (2013).
14. McNamara, K.E. Taking stock of community-based climate-change adaptation projects in the Pacific. *Asia Pacific Viewpoint*, **54**, 398–405 (2013).
15. Nalau, J., Becken, S., Schliephack, J., Parsons, M., Brown, C. & Mackey, B. The Role of Indigenous and Traditional Knowledge in Ecosystem-Based Adaptation: A Review of Literature and Case Studies from the Pacific Islands. *Weather, Climate, and Society*, **10**, 851–865 (2018).
16. McLeod, E., Burton-Adams, M., Förster, J., Franco, C., Gaines, G., Gorong, B., James, R., Posing-Kulwaum, G., Tara, M. & Terk, E. Lessons From the Pacific Islands - Adapting to Climate Change by Supporting Social and Ecological Resilience. *Frontiers in Marine Science*, **6**, 289 (2019).
17. Dacks, R., Ticktin, T., Mawyer, A., Caillon, S., Claudet, J., Fabre, P., Jupiter, S.D., McCarter, J., Meija, M., Pascua, P., Sterling, E. & Wongbusarakum, S. Developing biocultural indicators for resource management. *Conservation Science and Practice*, **e38** (2019).

18. Jamero, M., Motoharu, O., Miguel, E. & Nicholson, T. Community-based adaptation in low-lying islands in the Philippines: Challenges and lessons learned. *Regional Environmental Change*, **18**, 2249–2260 (2018).
19. Catalano, A. S., Lyons-White, J., Mills, M. M. & Knight, A. T. Learning from published project failures in conservation. *Biological Conservation*, **238** (2019).
20. Ashley, L., Zhumanova, M., Isaeva, A. & Dear, C. Examining changes in local adaptive capacity resulting from climate change adaptation programming in rural Kyrgyzstan. *Climate and Development*, **8**, 281–287 (2016).
21. Piggott-McKellar, A. E., McNamara, K. E., Nunn, P. D. & Watson, J. E. M. What are the barriers to successful community-based climate change adaptation? A review of grey literature. *Local Environment*, **24**, 374–390 (2019).
22. Simane, B. & Zaitchik, B. The Sustainability of Community-Based Adaptation Projects in the Blue Nile Highlands of Ethiopia. *Sustainability*, **6**, 4308–4325 (2014).
23. Vardakoulis, O. & Nicholles, N. in *Handbook of Climate Change Adaptation* (ed W.L Filho) Ch. 3 (2015).
24. Remling, E. & Veitayaki, J. Community-based action in Fiji's Gau Island: A model for the Pacific? *International Journal of Climate Change Strategies and Management*, **8**, 375–398 (2016).
25. Ensor, J.E., Park, S.E., Attwood, S.J., Kaminski, A.M. & Johnson, J.E. Can community-based adaptation increase resilience? *Climate and Development*, **10**, 134-151 (2018).
26. Ford, J.D., Sherman, M., Berrang-Ford, L., Llanos, A., Carcamo, C., Harper, S., Lwasa, S., Namanya, D., Marcello, T., Maillet, M. & Edge, V. Preparing for the health impacts of climate change in Indigenous communities: The role of community-based adaptation. *Global Environmental Change*, **49**, 129-139 (2018).
27. Nunn, P., Aalbersberg, W., Lata, S. & Gwilliam, M. Beyond the core: Community governance for climate-change adaptation in peripheral parts of Pacific Island Countries. *Regional Environmental Change*, **14**, 221–235 (2014).
28. Klöck, C. & Nunn, P. D. Adaptation to Climate Change in Small Island Developing States: A Systematic Literature Review of Academic Research. *The Journal of Environment & Development*, **28**, 196–218 (2019).
29. Nunn, P.D. & Kumar, R. Measuring peripherality as a proxy for autonomous community coping capacity: a case study from Bua Province, Fiji Islands, for improving climate change adaptation. *Social Sciences*, **8**, 1-26 (2019).
30. Korovulavula, I., Nunn, P.D., Kumar, R. & Fong, T. Peripherality as key to understanding opportunities and needs for effective and sustainable climate-change adaptation: a case study from Viti Levu Island, Fiji. *Climate and Development* (2019).

31. Ford, J.D., Berrang-Ford, L., Lesnikowski, A., Barrea, M. & Heymann, J. How to track adaptation to climate change: a typology of approaches for national-level application. *Ecology and Society*, **18**, 40 (2013).
32. Ford, J.D., Berrang-Ford, L., Biesbroek, R., Araos, M., Austin, S.E. & Lesnikowski, A. Adaptation tracking for a post-2015 climate agreement. *Nature Climate Change*, **5**, 967-969 (2015).
33. Kuruppu, N. & Willie, R. Barriers to reducing climate enhanced disaster risks in Least Developed Country-Small Islands through anticipatory adaptation. *Weather and Climate Extremes*, **7**, 72–83 (2015).
34. Warrick, O., Aalbersberg, W., Dumaru, P., McNaught, R. & Teperman, K. The ‘Pacific Adaptive Capacity Analysis Framework’: Guiding the assessment of adaptive capacity in Pacific island communities. *Regional Environmental Change*, **17**, 1039–1051 (2017).
35. Hagedoorn, L. C., Brander, L. M., van Beukering, P. J. H., Dijkstra, H. M., Franco, C., Hughes, L., ... Segal, B. Community-based adaptation to climate change in small island developing states: An analysis of the role of social capital. *Climate and Development*, **11**, 723–734 (2019).
36. Dilling, L., Prakash, A., Zommers, Z., Ahmad, F., Singh, N., de Wit, S., Nalau, J., Daly, M. & Bowman, K. Is adaptation success a flawed concept? *Nature Climate Change*, **9**, 572-574 (2019).
37. Duane, T. P. Community participation in ecosystem management. Symposium: The Ecosystem Approach. *Ecology Law Quarterly*, **24**, 771–797 (1997).
38. Richmond, N. & Sovacool, B. K. Bolstering resilience in the coconut kingdom: Improving adaptive capacity to climate change in Vanuatu. *Energy Policy*, **50**, 843–848 (2012).
39. Heltberg, R., Gitay, H. & Prabhu, G. Community-based adaptation: lessons from a grant competition. *Climate policy*, **12**, 143-163 (2012).
40. Buggy, L. & McNamara, K. E. The need to reinterpret “community” for climate change adaptation: A case study of Pele Island, Vanuatu. *Climate and Development*, **8**, 270–280 (2016).
41. Ensor, J. *Resilience realities: Resilience and development practice in Vanuatu* (Oxfam, 2016).
42. Titz, A., Cannon, T. & Krüger, F. Uncovering ‘Community’: Challenging an Elusive Concept in Development and Disaster Related Work. *Societies*, **8**, 71-99 (2018).
43. Westoby, R., McNamara, K.E., Kumar, R. & Nunn, P.D. From community-based to locally led adaptation: Evidence from Vanuatu. *Ambio* (2019).
44. Waylen, K.A., Fischer, A., MCGowan, P.J.K., Thirgood, S.J. & Milner-Gulland, E.J. Effect of local cultural context on the success of community-based conservation interventions. *Conservation Biology*, **24**, 1119-1129 (2010).
45. Barnett, J. & Campbell, J. *climate change and small island states: power, knowledge and the South Pacific* (Earthscan, 2010).

46. Nunn, P.D. The end of the Pacific? Effects of sea level rise on Pacific Island livelihoods. *Singapore Journal of Tropical Geography*, **34**, 143-171 (2013).
47. Maani, K. *Decision-making for climate change adaptation: A systems thinking approach*. Retrieved from National Climate Change Adaptation Research Facility website: https://www.nccarf.edu.au/sites/default/files/attached_files_publications/Maani_2013_Decision-making_for_climate_change_adaptation.pdf. (2013).
48. Sanneh, E. S. *Systems Thinking for Sustainable Development: Climate Change and the Environment* (Springer International Publishing, 2018).
49. Martin, P. C. M., Nunn, P., Leon, J. & Tindale, N. Responding to multiple climate-linked stressors in a remote island context: The example of Yadua Island, Fiji. *Climate Risk Management*, **21**, 7–15. (2018).
50. Hedger, M.M., Mitchell, T., Leavy, J., Greeley, M., Downie, A. & Horrock, L. *Evaluation of adaptation to climate change from a development perspective, desk review* (Institute of Development Studies (IDS), 2008).
51. Girot, P., Ehrhart, C., Oglethorpe, J., Reid, H., Rossing, T., Gambarelli, G.,.... Phillips, J. *Integrating community and ecosystem-based approaches in climate change adaptation responses* (Ecosystems & Livelihoods Adaptation Network, 2012).
52. Roy, J., Tschakert, P. Waisman, H., Abdul Halim, S., Antwi-Agyei, P., Dasgupta, P., Hayward, B., Kanninen, M., Liverman, D., Okereke, C., Pinho, P.F., Riahi, K. & Suarez Rodriguez, A.G. in *Global warming of 1.5°C*. (eds V. Masson-Delmotte et al.) Ch. 5 (Cambridge University Press, 2018).
53. Ranger, N., Harvey, A. & Garbett-Shiels, S. Safeguarding development aid against climate change: evaluating progress and identifying best practice. *Development in Practice*, **24**, 467-486 (2014).
54. Barnett, J. & O'Neill, S. Maladaptation. *Global Environmental Change*, **20**, 211-213 (2010).
55. Conway, D. & Mustelin, J. Strategies for improving adaptation practice in developing countries. *Nature Climate Change*, **4**, 339-342 (2014).
56. Mansuri, G. & Rao, V. Community-based and –driven development: A critical review. *The World Bank Research Observer*, **19**, 1-39 (2004).
57. Reid, H. Ecosystem- and community-based adaptation: learning from community-based natural resource management. *Climate and Development*, **8**, 4-9 (2016).
58. Nunn, P.D. & Kumar, R. Cashless Adaptation to Climate Change: Unwelcome yet Unavoidable? *One Earth*, **1**, 31-24 (2019).
59. Villanueva, P.S. *Learning to ADAPT: monitoring and evaluation approaches in climate change adaptation and disaster risk reduction: challenges, gaps and ways forward*, (SCR Discussion Paper 9). (Institute of Development Studies, Christian Aid and Plan International, 2010).
60. Sterrett, C.L. *Bringing Innovation to Scale: Resilience to Climate Change* (CARE International, 2015).

61. Onestini, M. *Final Evaluation Report for the Community Based Adaptation Programme* (UNDP, UNV, GEF and UNOPS, 2013).
62. Adger, W. N., Arnell, N. W. & Tompkins, E. L. Successful adaptation to climate change across scales. *Global Environmental Change*, **15**, 77–86 (2005).
63. United Nations Framework Convention on Climate Change (UNFCCC) *The State of Adaptation under the United Nations Framework Convention on Climate Change* (United Nations Climate Change Secretariat, 2013).
64. de Loë, R., Kreuzwiser, R., & Moraru, L. Adaptation options for the near term: Climate change and the Canadian water sector. *Global Environmental Change*, **11**, 231–245 (2001).

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Author contributions

K.E.M., P.N., A.P-M., R.C., F.N., F.A., E.J. and O.W. conceived and designed the research. K.E.M., R.C., R.W., A.P-M., R.K., T.C. and P.N. collected data. R.C., K.E.M., R.W., A.P-M., R.K. and P.N. analyzed the data. R.C., K.E.M., R.W., A.P-M., R.K. and P.N. wrote the paper.

Competing interests

The authors declare no competing interests.

Methods

Methods justification

This study involved a field-based qualitative approach with focus groups and interviews to allow qualitative exploration of multiple perceptions, attitudes and values that people hold, and to foreground stakeholder voices. Focus groups were employed because of the rich understandings that emanate from

the ability to mitigate researcher influence, allowing local participants to own discussion space^{65,66}. Group sessions are also particularly useful when working with communal societies like those in the Pacific Islands⁶⁷. Focus groups were split by gender or age where possible to limit influences from entrenched hierarchies. Individual semi-structured interviews, structured to focus conversation yet also flexible to optimize the potential for knowledge production⁶⁸, were also conducted to acquire information which may not have been disclosed in group settings⁶⁹. This multi-method enquiry facilitated data completeness and confirmation in support of more coherent understandings⁷⁰. Where researchers were not competent in preferred vernaculars, gatekeepers were utilized for translations and for providing trusted access to rural communities^{71,72}.

Focus group and interview design

To elicit a robust understanding around the long-term performance of initiatives in reducing vulnerability and to ensure community sites were evaluated according to the same criteria, an evaluative framework was developed comprising five key components: appropriateness, effectiveness, equity, impact and sustainability. These were selected based on a review of literature on monitoring and evaluation indicators and rubrics^{50,59-64,73}, considered in the context of what constitutes successful adaptation, which was conducted at the initial stages of this initiative. Although a range of components were found, only those that were considered relevant and appropriate for the study participants as well as the specificities of CBA were selected (Table 1). Focus group guides and interview schedules were structured by these components and, through a research project inception workshop, developed in consultation with and feedback from eight partner organizations that have long histories of working with communities at the grassroots level. This ensured contextual relevance and the optimization of overall impact by aligning with the needs of their work.

The focus group and interview guides had clear and logical structures: introductions and verbal consents to provide cognition, icebreakers to foster rapport, questions/activities around livelihood threats, climate experience and responses, questions/activities relevant to each evaluation component, and opportunity for final remarks⁷¹. Activities involved creating ranked lists of livelihood threats, creating timelines showing major climatic events and the completion of Likert scales where participants were asked to evaluate the performance of each of the five components of adaptation success from 1 to 5 (where 1= very good and 5= very poor).

Data collection

44 focus groups and 62 semi-structured interviews were conducted by seven researchers, who are authors in this paper, across 20 rural communities in the Federated States of Micronesia (n=3), Fiji (n=6), Kiribati (n=2) and Vanuatu (n=9) between April 2017 and July 2019. The selection of communities were dependent on two factors: 1) the research team's networks and partner organizations as this was deemed the most appropriate avenue for trusted access to communities, and 2) to best represent different points along core-periphery gradients (see above).

The total number of focus groups can be disaggregated into 18 all-male groups, 20 all-female groups, four mixed groups and two youth groups. All 415 participants across the focus groups and interviews were involved to some extent in adaptive initiatives implemented by external agencies (i.e. by government, NGOs, university or a combination of these). A majority of the participants were local community members, although government officials and representatives from donor or regional organizations were also interviewed. As our sampling strategy was largely based on expediency, this study may be limited in its capacity to be representative of all diverse groups. Attempts to capture diverse viewpoints, however, have been made by selecting communities across core-periphery gradients and implementing some level of quota sampling to ensure that participants of diverse age and gender were included.

Apart from a few participants with English proficiency, all focus groups and interviews were conducted in local languages with translation provided by researchers or local gatekeepers who were employees of partner organizations or from our networks in these countries. Gatekeepers were additionally critical for providing necessary introductions and inviting participants to be involved. Most focus groups and interviews were recorded using a digital recorder or, in cases where recordings were not taken, detailed notes were taken. As a study involving human participants, a series of ethical approvals were provided by the University of Queensland and the University of the Sunshine Coast and all participants gave their informed consent to participate in these voluntary focus groups and interviews.

Data analysis

After interviews and focus groups recordings were transcribed verbatim, all primary researches were involved in two layers of latent content analysis (LCA) which is an interpretive technique employed for its ability to code social data and derive both surface and underlying meanings⁷⁴. First, to understand participant judgements on the performance of CBA initiatives against the chosen evaluation components, a coding system helped analyze language and sentiments and categorize content into four broad analytical codes⁷⁵ under each evaluation component: high, neutral (i.e. no perceived effect), medium (i.e.

with both high and low performance aspects) and low performance (see Extended Data 1). Each initiative was given a total score by receiving 3 points for every high performing component, 2 points for every neutral or medium performing component and 1 score for low performing components. From this, the overall performance of each initiative could be derived, and these fell neatly into 10 separate groups, with each group containing the initiatives that had the same total scoring count. These results have been placed along a scale from high to low performance (Figure 1). The second layer of analysis involved transforming findings under all evaluation components into key ‘themes’ which are groups of content that share common underlying meanings on an interpretive level⁷⁶. This gave rise to the common characteristics outlined in Tables 3-5 and the four optimization points.

Simple measures of proportion were also used to identify any potential patterns in the spread of variables across the performance scale (Figure 1). This involved calculating how many initiatives of a specific country, adaptation type, funding body or implementing agency were present in the high (Groups 1-3), medium (Groups 3-6) and low (7-10) performing groups in relation to their total count (across all groups). For example, there were 13 locally-funded initiatives in this study, of which 5 were high performing, 6 were medium performing and 2 were low performing compared with the 18 internationally-funded initiatives which saw 5 high performing, 7 medium performing and 6 low performing.

Data Availability

The data that support the findings of this study are not publicly available due to them containing information that would compromise research participant confidentiality and anonymity.

Methods-Only Reference List

65. Kamberelis, G. & Dimitriadis, G. *Focus groups from structured interviews to collective conversations* (Routledge, 2013).
66. Leavey, P. *Oxford Handbook of Qualitative Research* (Oxford Library of Psychology, 2014).
67. Lata, S. & Nunn, P. Misperceptions of climate-change risk as barriers to climate-change adaptation: A case study from the Rewa Delta, Fiji. *An Interdisciplinary, International Journal Devoted to the Description, Causes and Implications of Climatic Change*, **110**, 169–186 (2012).
68. Brinkmann, S. in *Oxford Handbook of Qualitative Research* (ed P. Leavey) Ch.14 (Oxford Library of Psychology, 2014).
69. Creswell, J.W. *Research Design: Qualitative, Quantitative and mixed methods approaches* (3rd ed.) (Sage Publications, 2009).

70. Seawright, J. *Multi-Method Social Science* (Cambridge University Press, 2016).
71. Hennink, M.M. *Focus group discussions* (Oxford University Press, 2014).
72. McFadyen, J., & Rankin, J. The Role of Gatekeepers in Research: Learning from Reflexivity and Reflection. *GSTF Journal of Nursing and Health Care*, **4**, 82–88 (2016).
73. Faulkner, L., Ayers, J. & Huq, S. Meaningful Measurement for Community-Based Adaptation. *New Directions for Evaluation*, **2015**, 89-104 (2015).
74. Bengtsson, M. How to plan and perform a qualitative study using content analysis. *NursingPlus Open*, **2**, 8–14 (2016).
75. Cope, M. in *Qualitative Research in Human Geography (3rd ed)* (ed I. Hay) Ch. 14 (Oxford University Press, 2010).
76. Graneheim, U. H. & Lundman, B. Qualitative content analysis in nursing research: Concepts, procedures and measures to achieve trustworthiness. *Nurse Education Today*, **24**, 105–112 (2004).

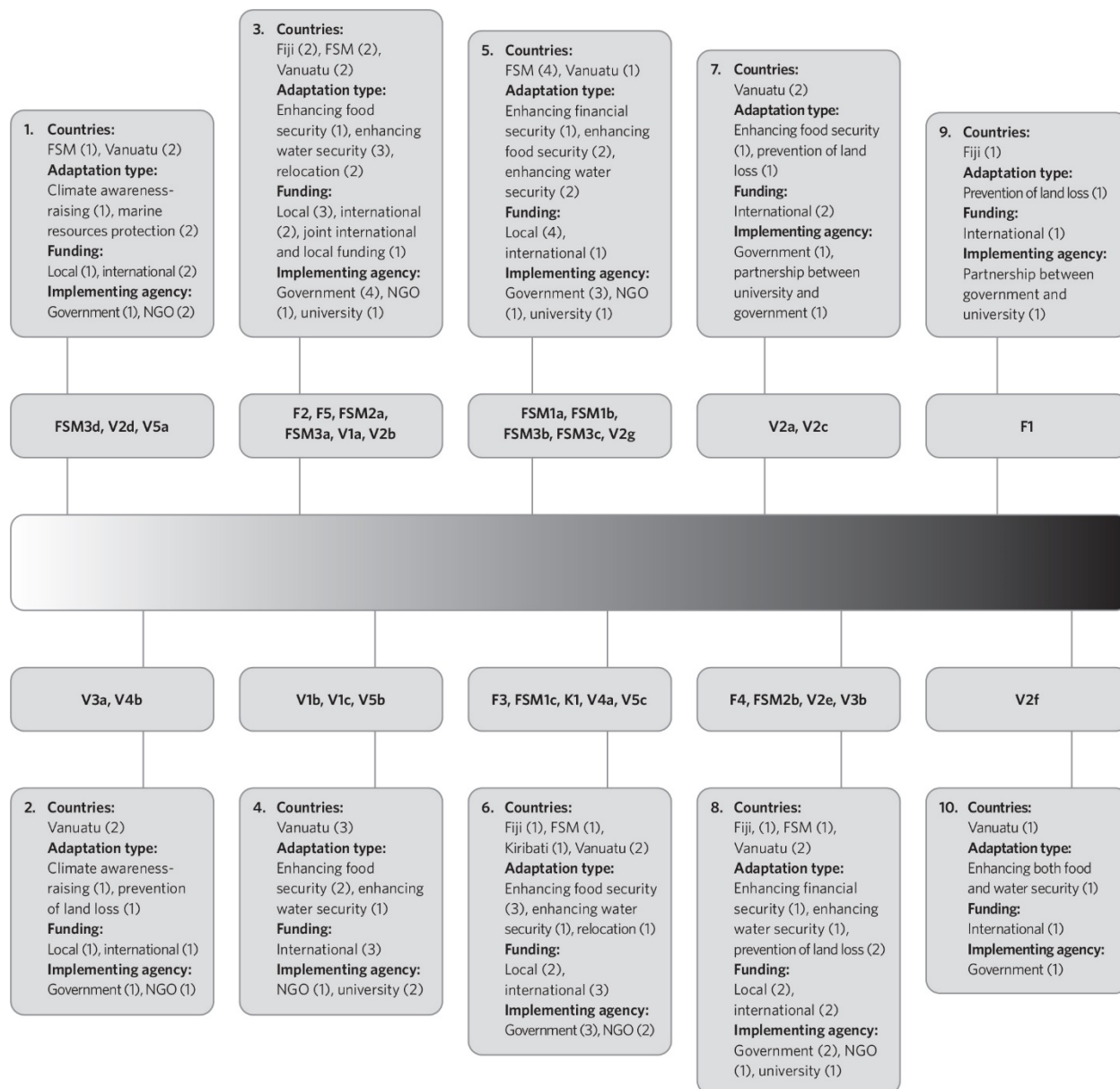


Figure 1: Spread of evaluated initiatives across a scale from high performance (white) to low performance (black) with the number of initiatives (in brackets) associated with each country, adaptation type, funding body and implementing agency displayed

Table 1: Definition of components of adaptation success and reasons for inclusion in study

Component of adaptation success	Definition	Reasons for inclusion in study
<p>Appropriateness <i>Sometimes referred to as 'legitimacy'⁵⁹, 'relevancy'⁶⁰ or 'relevance'⁶¹</i></p>	<p>Overall relevance of the project and associated suitability of the initiatives in terms of community priorities and their cultural and social ethos</p>	<ul style="list-style-type: none"> • This component is critical for CBA evaluation due to the nature of the approach as one that integrates local context, knowledge, capabilities and priorities^{7,8} • Successful CBA is more likely when CBA is relevant to existing social forms, effects change from within cultures and occurs as part of culture⁷
<p>Effectiveness</p>	<p>Extent to which the initiatives have achieved intended objectives, and includes the products, capital goods and services which resulted directly from the intervention</p>	<ul style="list-style-type: none"> • Effectiveness was identified as a core aspect or basic element of most monitoring and evaluation studies/rubrics for deriving adaptation success^{50,62,59,63} • This criterion for success is complemented by other evaluation components as relying solely on effectiveness is insufficient^{64,62}
<p>Equity</p>	<p>Inclusion and benefit of initiatives for everyone within the community, specifically any marginalized groups</p>	<ul style="list-style-type: none"> • This component was considered critical as there are existing concerns and censures that CBA relies on an assumed imagery of 'community' as devoid of intra-communal differences. Overlooking differences in power, access and control of resources can exclude the most vulnerable and entrench underlying social structures and power relations, thereby leading to inequitable outcomes that are counterproductive to successful adaptation^{4,40}
<p>Impact</p>	<p>The wider direct or indirect, intended or unintended, long-term effects of the initiative, whether positive or negative</p>	<ul style="list-style-type: none"> • Understanding the impact of projects beyond specific climate-related objectives is important as CBA has become increasingly recognized as a 'pro-poor' and 'no-regrets' approach that has synergies with development (i.e. fostering benefits regardless of future climate change scenario)^{24,39,50} • Any adaptation has the potential to create unintended impacts across temporal and spatial scales⁶²
<p>Sustainability</p>	<p>Extent to which initiatives have been maintained post project lifecycle, and the extent to which processes have continued once the initial inputs have ceased</p>	<ul style="list-style-type: none"> • This was selected as an important consideration in the Pacific context as CBA project cycles are short (average timeframe of 3 years) and long-term funding is a challenge to secure^{14,24}. With these issues, it is important to understand whether adaptation is occurring beyond project durations

Table 2: Overview of the 14 case study sites and 32 CBA initiatives

Case Study code	Country	Main climate change risks	Livelihoods context	Types of adaptation initiatives	Activities involved
F1	Fiji	Coastal pressures from tidal inundation and shoreline erosion	Coastal communities that are largely subsistence-based, relying heavily on marine and terrestrial resources	F1) Prevention of land loss	F1) Construction of sea wall along coastline
F2	Fiji	Coastal pressures form tidal inundation, shoreline erosion and saltwater intrusion	Community livelihoods reliant on fishing, subsistence agriculture and cash from market sales of locally made crafts and fish or crop surpluses	F2) Relocation	F2) Planned village relocation where entire community is moved and resettled in less exposed area
F3	Fiji	Coastal intrusion and storm surge activity	Community relies heavily on subsistence fishing and crop agriculture with surplus sold for income	F3) Relocation	F3) Same as F2
F4	Fiji	Cyclones, periodic intense rainfall, flooding, coastal erosion and inundation	Subsistent community dependent on locally-acquired marine resources supplemented by crops and <i>kava</i> sales	F4) Prevention of land loss	F4) Construction of river wall
F5	Fiji	Sea level rise, inundation and tropical cyclones	Subsistent community dependent on marine and coastal environments	F5) Relocation	F5) Same as F2 and F3
FSM1 (a, b, c)	FSM		Subsistent community based on farming with income also supplemented by selling <i>sakau (kava)</i>	FSM1a) Enhancing water security FSM1b) Enhancing food security FSM1c) Enhancing water security	FSM1a) Provision and installation of rainwater tanks for water harvesting FSM1b) Establishment of plant nursery and greenhouse to support and encourage crop growth FSM1c) Discourage deforestation and encourage reforestation to prevent pollution and sedimentation of drinking water supply
FSM2 (a, b)	FSM	Drought, shoreline erosion and inundation from rising sea levels, storm surges and high tides	Two-thirds of community engaged in subsistence livelihoods, remaining have income through formal employment or fish and <i>sakau (kava)</i> sales	FSM2a) Enhancing water security FSM2b) Prevention of land loss	FSM2a) Provision and installation of water tanks for water harvesting FSM2b) Construction of sea wall
FSM3 (a, b, c, d)	FSM	Drought, flooding and cyclones	Close-knit subsistent community dependent on marine ecosystems for food (many fish or plant together)	FSM3a) Enhancing water security FSM3b) Enhancing food security	FSM3a) Provision and installation of rainwater tank for water harvesting FSM3b) Establishment of aquaculture sites for clam farming

				FSM3c) Enhancing financial security FSM3d) Marine resources protection	FSM3c) Establishment of piggeries, providing training on management and creating opportunities to sell pigs and by-products FSM3d) Establishment of a marine park area to protect the ecosystem and limit use of marine resources
K1	Kiribati	Coastal erosion and salt-water intrusion	Decline of traditional subsistence activities due to reliance on imported foods, and limited income opportunities, the main being selling <i>copra</i> (dried coconut kernel), surplus foods or handicrafts (although limited market access)	K1) Enhancing food security	K1) Trial of climate-resilient seeds, establishment of community plots, provision of pigs and relevant infrastructure as well as compost training
V1 (a, b, c)	Vanuatu	Cyclones, varying frequency and intensity of rainfall (drought to heavy downpours)	Largely subsistent community with food grown for consumption, main income streams are livestock, forestry or selling <i>copra</i>	V1a) Enhancing water quality V1b) Enhancing food security V1c) Enhancing food security	V1a) Protection of harvested water from pollution and insect-borne diseases V1b) Establishment of chicken coop and provision of training in chicken rearing for meat and eggs V1c) Establishment of fish farm demonstration site and provision of training in fish farming
V2 (a, b, c, d, e, f, g)	Vanuatu	Storm surges, erosion, cyclones and drought	Subsistent communities dependent on marine ecosystems with main income streams being tourism, fishing, agriculture and overseas seasonal work	V2a) Enhancing food security V2b) Enhancing food security V2c) Prevention of land loss V2d) Marine resources protection V2e) Enhancing financial security V2f) Enhancing both food and water security V2g) Enhancing water security	V2a) Establishment of a plant nursery and provision of crop cuttings and agroforestry training V2b) Provision of solar food dryers to enable food preservation and livelihood diversification V2c) Establishment of tree nursery to protect foreshore from erosion V2d) Protection of coral ecosystems through training and the creation of incentives around crown-of-thorns starfish control V2e) Establishment of beehives and provision of training on maintenance V2f) Installation of self-composting toilets to save water, protect groundwater supplies and improve soil nutrient deficiencies and fertility

					V2g) Establishment of water piping systems to provide water to villages
V3 (a, b)	Vanuatu	Tidal surges, coastal erosion, cyclones and drought	Subsistent community based on agriculture and fishing, although large portion of women make handicrafts to sell at market in Port Vila, many are also seasonal workers	V3a) Prevention of land loss V3b) Enhancing water security	V3a) Construction of a sea wall along coastline V3b) Provision of rainwater tanks for water harvesting
V4 (a, b)	Vanuatu	Drought, cyclones, heavy rain, storm surges, sea level rise	Largely subsistent communities reliant on crops from gardens, fish, fruit and some imported foods	V4a) Enhancing food security V4b) Climate awareness-raising	V4a) Establishment of demonstration plots for agriculture and provision of training on nutrition and agricultural techniques V4b) Provision of participatory presentations, movie nights and animations about climate change, and distribution of noticeboards with information on climate change, disasters and weather updates
V5 (a, b, c)	Vanuatu	Cyclones, drought and flooding	Community livelihoods based on agriculture and/or semi-commercial fishing; some also import goods such as tinned food	V5a) Climate awareness-raising V5b) Enhancing water security V5c) Enhancing food security	V5a) Same as V4b, provision of disaster risk reduction handbooks and tools, development and updating of community action plans V5b) Provision of awareness sessions, training in water-saving techniques and water usage diaries V5c) Same as V4a and provision of solar food dryer for food preservation

Table 3: Common characteristics among high performing CBA initiatives

Groups of initiatives	Common characteristics	Details of initiative performance
Groups 1 to 3	1) Effective production of outputs that linked directly to improved adaptive capacity	<ul style="list-style-type: none"> • Maintenance of healthy marine ecosystem and fish stock to improve food security and support livelihoods related to tourism or fishing (FSM3d, V2d) • Effective protection of land against tidal surges and erosion (V2d) • Effectively increased climate change awareness and knowledge (V4b, V5a)
	2) Appropriateness to local context in terms of culture, livelihoods, resources and priorities	<ul style="list-style-type: none"> • New relocation site designed to reassemble cultural and material assets which enhanced local approval and perceptions around initiative viability (F5) • Information delivery in local dialects to ensure all community members could be involved (not just those who spoke Bislama or English) (V4b, V5a). V4b ranked slightly lower than V5a due to lacking targeted information around most pressing concern of drought • Complementarity to traditional knowledge through: 1) Helping to fill gaps where traditional knowledge was perceived as less reliable due to climate variability (V5a); 2) Emergence of integrated knowledge systems (new and traditional knowledge) to either detect imminent cyclones (V4b) or optimize outputs from gardens (V4a) • Based around a marine ecosystem that provides critical resources for community livelihoods (FSM3d, V2d) • Integration of locally appropriate livelihood alternatives in new relocation site fostered local approval and positive perceptions around initiative viability (F2) • New relocation site designed to imitate original site's proximity to ocean and food gardens so that livelihoods can be maintained (F5) • Integration of local resources enabled community to easily source inputs and maintain implemented sea wall (V2) • Responding to direct requests from local communities ensured that initiatives aligned with local priorities (FSM3d, V2d) • Relocation implemented for communities that perceived it as necessary for the risks they were facing (F2, F5) • Alignment with local priorities and concerns around drought (FSM2a, FSM3a) and finding an alternative to wells (FSM3a)
	3) Moving away from geographical parameters of a 'community'	<ul style="list-style-type: none"> • 'Whole of island' approaches where all local communities on an island can be involved and perceive themselves as equally responsible for, and benefiting from, initiatives (FSM3d, V2d) • Success of initiative largely attributed to unique ownership through a training center. This minimized internal disputes and created a demonstration site through which community members could then transfer knowledge and skills to households (V1a) • Initiative failed within chosen community but retained widespread impact as one woman took ownership and provided training to others (i.e. initiative succeeded with 'community' based on woman's networks which are beyond confines of one island or province). She was subsequently employed to train others (V2b)
	4) Ability to simultaneously address climatic and non-climatic livelihood pressures	<ul style="list-style-type: none"> • Benefits beyond reducing exposure to risk provided) which addressed non-climate related pressures (e.g. improved local housing, access to roads, markets, schools and health facilities) and enhanced local approval of initiative (F2) • Positive impacts beyond water security (e.g. improved health and sanitation) (FSM2a) • Improved fiscal wellbeing by improving local access to water which reduced need to purchase bottled water from other islands (FSM2a, FSM3a)

	5) Integration with EbA	<ul style="list-style-type: none"> • EbA integrated by basing initiatives on the protection of local marine ecosystems, and their associated services, that are critical to livelihoods (for food, fishing and tourism) (FSM3d, V2d)
	6) Overlooking future trends	<ul style="list-style-type: none"> • Implementers overlooked likelihood of longer drought intervals so water pumps (for when water tank levels fall below extraction lines) were not provided (FSM3a) • Insufficient number of water tanks provided by overlooking rising population trends (FSM2a)

Table 4: Common characteristics among medium performing CBA initiatives

Groups of initiatives	Common characteristics	Details of initiative performance
Groups 4 to 6	1) Appropriateness to local context in terms of priorities	<ul style="list-style-type: none"> • Responding to direct requests from local communities ensured that initiatives aligned with local priorities (FSM1a, FSM1b, FSM3b, FSM3c) • Relocation appropriate for community that understood life in original location was unviable (F3) • Local concerns and priorities around lack of water (V5b), pollution of drinking water (FSM1c) and food security addressed (K1, V4a, V5c)
	2) Women’s empowerment and improved equity	<ul style="list-style-type: none"> • Progressed gender equity in terms of participation, decision-making and benefit (V4a, V5b, V5c). Women have acquired leadership roles and noted growth in motivation and confidence while men acknowledge role and influence of women in decision-making
	3) Inequity stemming from overlooking social and/or cultural considerations and dynamics	<ul style="list-style-type: none"> • Attempted to provide equal opportunity but did not target specific groups based on underlying cultural and social differences which hindered ability to be wholly inclusive (i.e. equal but not equitable) (K1) • Two villages (seemingly coherent with strong family links) united as one ‘community’ which gave rise to internal disputes resulting in one community being excluded while the other acquired significant benefits for all members (V2g) • Utilizing ‘community’ parameters based on geography meant that a minority religious group that is scattered across these geographical ‘communities’ became even more marginalized and then excluded (V4a) • Not adequately recognized that the distribution of a high value cultural asset (not every member of community received pigs) could generate social status disparities (FSM3c)
	4) Initiatives not designed to promote the self-sufficiency of communities and ability to maintain initiatives long-term	<ul style="list-style-type: none"> • Plastic parts of provided equipment were not affordable or attainable for replacement/maintenance in communities with little available cash, rendering initiative unsustainable (V5b, V5c) • Community unable to afford or source needed plant seedlings for maintenance of nursery stocks once funding ceased (FSM1b) • Implementation of water tanks at high elevation made upkeep difficult and only one tank provided (i.e. no reserve tank for when issues arose) (FSM1a) • Proper maintenance of fencing deemed difficult as fences cemented into a soft calcareous sandy substrate (FSM3c) • Poor design of new relocation site (i.e. threat of landslides, houses leaking, poor drainage, erosion, and health concerns due to limited number of septic tanks), which generated negative perceptions around long-term viability of site, although some satisfaction with other facilities (e.g. solar power, water tanks and flush toilets) (F3) • Partly relying on stricter laws which are yet to be implemented and enforced (stop deforestation and rubbish dumping into waterways), rather than taking practical approaches such as empowering communities to change behaviour (FSM1c)

Table 5: Common characteristics among low performing CBA initiatives

Groups of initiatives	Common characteristics	Details of initiative performance
Groups 7 to 10	1) Appropriateness to local context in terms of priorities and desires	<ul style="list-style-type: none"> • Water insecurity as the key concern addressed (V3b) • Storm surges and foreshore erosion as key concerns addressed (V2c) • Sea wall was perceived as needed by local community (FSM2b) • Catered to community desires to have beehive (community had heard that this livelihood alternative had worked effectively elsewhere) (V2e)
	2) Overlooking future climatic trends	<ul style="list-style-type: none"> • Beehive became unsustainable for several reasons, including its high susceptibility to climate extremes (V2e) • Trees planted along coastline required replenishment as tidal surge frequency increased (V2c) • Overlooking future intensification of climate impacts resulted in maladaptive outcome (water rising above sea walls and becoming dammed) (F1)
	3) Focus on preventing land loss	<ul style="list-style-type: none"> • Four out of five prevention of land loss initiatives in this study ranked poorly (F1, F4, FSM2b, V2c)
	4) Poor local approval and/or ownership	<ul style="list-style-type: none"> • Lack of genuine ownership as initiative was privately owned and individuals paid to manage it. Initiative ceased due to inefficiencies from turnovers and land tenure issues (V2c) • Communities perceived coastal inundation/erosion as growing source of risk, but river walls implemented which ultimately caused erosion of the river channel and local disapproval (F4) • Community disapproval stemming from maladaptation (water levels rise over sea walls and become dammed inside village) which increases vulnerability (F1) • Poor ownership and approval stemming from poor alignment with community desires and socio-cultural context in terms of having a self-composting toilet and using human waste as fertilizer (V2f)
	5) Poor consultation	<ul style="list-style-type: none"> • Insufficient consultation with local communities meant initiatives were not aligned with socio-cultural context and local desires (V2f) as well as key climate risks to livelihoods (F4) • Although the community (leaders and local school executives) was consulted in early stages, NGOs were not, which was perceived as problematic as they may have had differing opinions regarding design of sea wall and materials used in construction (FSM2b)

Extended Data 1

Group	Country	Adaptation Type	Appropriateness	Effectiveness	Equity	Impact	Sustainability
1	FSM	Marine resources protection (FSM3d)					
	Vanuatu	Marine resources protection (V2d)					
		Climate awareness-raising (V5a)					
2	Vanuatu	Prevention of land loss (V3a)					
		Climate awareness-raising (V4b)					
3	Fiji	Relocation (F2, F5)					
	FSM	Enhancing water security (FSM2a, FSM3a)					
		Enhancing water security (V1a)					
	Vanuatu	Enhancing food security (V2b)					
4	Vanuatu	Enhancing food security (V1b, V1c)					
		Enhancing water security (V5b)					
5	FSM	Enhancing water security (FSM1a)					
		Enhancing food security (FSM1b, FSM3b)					
		Enhancing financial security (FSM3c)					
	Vanuatu	Enhancing water security (V2g)					
6	Fiji	Relocation (F3)					
	FSM	Enhancing water security (FSM1c)					
	Kiribati	Enhancing food security (K1)					
	Vanuatu	Enhancing food security (V4a, V5c)					
7	Vanuatu	Enhancing food security (V2a)					
		Prevention of land loss (V2c)					
8	Fiji	Prevention of land loss (F4)					
	FSM	Prevention of land loss (FSM2b)					
	Vanuatu	Enhancing financial security (V2e)					
		Enhancing water security (V3b)					
9	Fiji	Prevention of land loss (F1)					
10	Vanuatu	Enhancing food and water security (V2f)					