World Development 127 (2020) 104748

Contents lists available at ScienceDirect

World Development

journal homepage: www.elsevier.com/locate/worlddev

An analysis of UNFCCC-financed coastal adaptation projects: Assessing patterns of project design and contributions to adaptive capacity

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ARTICLE INFO

Article history:

Keywords:
Climate adaptation
Coastal resilience
Adaptive capacity
Climate finance
Ecosystem-based adaptation
Global

ABSTRACT

Coastal regions of developing countries are highly vulnerable to climate impacts. Climate change is projected to increase sea level rise, coastal storm events, and natural resource scarcity, impacting coastal ecosystems and societies. These climate impacts intersect with other anthropogenic stressors contributing to the degradation of coastal habitats and ecosystems (driven by, among other things, development, encroachment and pollution), increasing the risk of coastal hazards. Given the complexities of coastal adaptation and the reality of scarce financial and human resources, policymakers must make challenging decisions regarding which adaptation strategies to prioritize. This study seeks to understand: 1) What approaches to coastal adaptation have been most commonly implemented in projects financed through multilateral adaptation funds? and 2) Were the projects designed to build climate-specific or broader adaptive capacity? Using a content analysis of project proposals for 60 coastal adaptation projects financed through multilateral adaptation funds across 39 countries (as well as two regional projects), we categorized adaptation approaches and assessed contributions to adaptive capacity. Our findings indicate that policy, planning, and capacity-building, as compared to more tangible implementation activities, have characterized most coastal adaptation projects in the past 15 years. We also found a common emphasis on climate-specific adaptive capacity which diverges from the widely discussed need to address climate change and development priorities synergistically. In the context of limited resources, decisions regarding which adaptation approaches to invest in inherently involves trade-offs that need to be explicitly acknowledged. While numerous regional studies have analyzed these trade-offs, our study provides a global context and identifies potential areas of underinvestment for coastal adaptation in developing countries.

1. Introduction

Coastal adaptation to climate change is an urgent development priority. Coastal regions of developing countries are highly vulnerable to climate impacts. Climate change is projected to increase sea level rise, coastal storm events, and natural resource scarcity, impacting coastal ecosystems and societies (IPCC, 2018; Savo, Morton, & Lepofsky, 2017; Whitney et al., 2017). These climate impacts intersect with other anthropogenic stressors contributing to the degradation of coastal habitats and ecosystems (driven by, among other things, development, encroachment and pollution), increasing the risk of coastal hazards (Barrett & Constas, 2014; Béné, Newsham, Davies, Ulrichs, & Godfrey-Wood, 2014; Brown, 2015; Lotze et al., 2006; Spalding et al., 2014). Coastal adaptation is a particularly high priority because of the large number of people exposed to climate risks. Approximately sixty-five percent of the world's population lives near a coast (De Souza et al., 2015), and the annual global consequences of coastal flooding are projected to exceed $1 trillion (USD) if significant steps towards adaptation are not taken (Hallegatte, Green, Nicholls, & Corfee-Morlot, 2013). Of course, coastal populations are not evenly vulnerable, as exposure is only one component of vulnerability, and differences in sensitivity and adaptive capacity also impact vulnerability (Cinner et al., 2012; Halpern, Selkoe, Micheli, & Kappel, 2007; Marshall, Tobin, Marshall, Gooch, & Hobday, 2013). Coastal adaptation projects can involve many strategies targeting exposure, sensitivity and adaptive capacity in an effort to reduce vulnerability (Adger, Quinn, Lorenzoni, Murphy, & Sweeney, 2013; Lane, Mercer Clarke, Forbes, & Watson, 2013). The diverse climate risks

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https://doi.org/10.1016/j.worlddev.2019.104748
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and tight coupling of people and ecosystems along coastlines provides an opportunity to study the prevalence of climate-specific strategies or broader resilience-building initiatives (Adger, Hughes, Folke, Carpenter, & Rockstrom, 2005; McClanahan & Cinner, 2012; NRC, 2014).

The international community has committed to supporting developing countries in meeting their urgent adaptation needs, including coastal priorities, as enshrined in the United Nations Framework Convention on Climate Change (UNFCCC) and reaffirmed in the Paris Agreement. Small Island Developing States (SIDS), in particular, are globally recognized as having a special status and eligibility for multilateral adaptation finance, due to the existential threat posed by climate change for these nations (Barnett, 2001; Neef et al., 2018; Neumann, Vafeidis, Zimmermann, & Nicholls, 2015). However, total available funding is far below identified needs (Gomez-Echeverri, 2013; Pickering, Betzold, & Skovgaard, 2017; Rosegrant, Dey, Valmonte-Santos, & Chen, 2016; UNEP, 2018). A recent analysis of estimated adaptation finance needs in 50 Nationally-Determined Contributions (NDCs) found that the costs were approximately $500 billion for the period from 2020 to 2030 for these countries, suggesting substantially higher global costs (UNEP, 2018). Against this context, the UN funds analyzed here have approved a total of approximately $5.1 billion for adaptation since their inception (this includes funding for both adaptation and cross-cutting projects for the GCF) (Global Environment Facility, 2018; LDCF, SCCF Council, 2018; Adaptation Fund, 2018; Green Climate Fund (GCF), 2019).

Important decisions must be made regarding which adaptation strategies to support with these limited funds. For instance, following a long history of coastal protection strategies that relied on built infrastructure, "living shorelines" and nature-based strategies are rapidly gaining interest as potentially more sustainable alternatives for building resilience (Arkema, Scyphers, & Shepard, 2017; Beck et al., 2018; Narayan et al., 2016). More broadly, approaches range from impact-specific solutions, such as building sea walls for coastal protection (Charlier, Chaineux, & Morcos, 2005), to broader resilience-building strategies, such as capacity building to promote adaptive capacity (Marshall & Marshall, 2007; Marshall et al., 2013). Given the complexities of coastal adaptation and the scarce financial and human resources available to support adaptation, policymakers must make challenging decisions regarding which adaptation strategies to prioritize. A particular tension for project design is the trade-off between strategies that build climate-specific adaptive capacity or those that build broader adaptive capacity (Inderberg, Eriksen, O'Brien, & Sygna, 2014; Nagoda, 2015; Weiler, Klöck, & Dornan, 2018).

Through a review of 60 coastal projects in 39 countries (as well as two regional projects) receiving funding from multilateral adaptation funds, including the Global Environment Facility (GEF)'s Least Developed Countries Fund (LDCF) and Special Climate Change Fund (SCCF), the Adaptation Fund (AF), and the Green Climate Fund (GCF), this analysis synthesizes current and historical approaches to the design of coastal adaptation projects in developing countries. This study addresses two key questions: 1) What approaches to coastal adaptation have been most commonly implemented in projects financed through multilateral adaptation funds? and 2) Were the projects designed to build climate-specific or broader adaptive capacity?

Although adaptation is inherently context-specific and appropriate strategies will vary from one place to another (Ayers, Huq, Faisal, & Hussain, 2014; Christiansen, Olhoff, & Traerup, 2011; De Souza et al., 2015; Fischer, 2018; Nelson, Adger, & Brown, 2007; Shiferaw, Okello, & Reddy, 2009), there is significant value in synthesizing the past experiences with coastal adaptation across multiple developing countries, including identifying trends in the approaches utilized and their contributions to building adaptive capacity. While multilateral adaptation funds represent only a small fraction of the adaptation finance landscape, they have a particularly important role to play as a goal of these funds is to pilot innovative strategies and build the global knowledge base on adaptation (Kandlikar & Risbey, 2000). These funds are designed to "crowd-in" additional adaptation finance and lay a foundation for broader adaptation efforts. Therefore, if certain adaptation approaches are not well-represented in the global portfolio, innovation and knowledge development on adaptation may be compromised, and adaptation efforts beyond these specific funds may suffer.

2. Theoretical framework

2.1. Categorizing approaches to adaptation

Many different strategies can be used to achieve adaptation goals. These strategies (or adaptation options) can be characterized in terms of their sectoral focus, their temporal emphasis (e.g. short-term or long-term, or proactive or reactive), the actors involved (e.g. public or private, national or local), and the approaches used (structural/physical, social and institutional) (Biagini, Bierbaum, Stults, Dobardzic, & McNeeley, 2014; Burnham & Ma, 2018; Klein et al., 2001; Nelson et al., 2007; Noble et al., 2014; Tompkins & Eakin, 2012). See IPCC 2014 Chapter 14 for a discussion of ways to categorize adaptation options (Noble et al., 2014).

Biagini et al., 2014 developed one of the most widely used typologies based on a grounded theory analysis of adaptation projects funded through the GEF. They identified a number of different approaches to adaptation, spanning from protective measures, such as infrastructural or ecosystem-based approaches, to livelihood support or capacity-building and planning measures (Fig. 1). In the adaptation projects analyzed, they identified a total of 158 discrete adaptation activities, which they categorized into 10 groups. Due to its particular relevance for analyzing multilateral coastal adaptation projects, in this paper, we use a slightly modified version of their adaptation typology. Because we coded adaptation approaches at the outcome level (an aggregation of activities), while they conducted their analysis at the activity level, we combined: 1) "behavior and practice" with "technology", as these approaches were almost always implemented jointly, 2) "management and planning" with "policy" to capture the full spectrum of policy and planning in one category, and 3) "information" with "warning and observing system" or "capacity-building" as appropriate, as all information needs overlapped with one of these categories at the outcome level. These changes do not reflect anything specific to coastal adaptation, but rather simply an aggregation based on the level of analysis. Conducted at the outcome level, our analysis was less fine-grained and did not capture the distinctions that can be seen at the activity level, necessitating a slightly simplified coding scheme. In order to be consistent with the coastal adaptation literature and to reflect key debates in coastal adaptation planning, we renamed "green-infrastructure" as "ecosystem-based adaptation." Ecosystem-based adaptation has gained significant traction recently (see for example the IPCC Special Report "The Ocean and Cryosphere in a Changing Climate" (IPCC, 2019), and by using this terminology, our analysis engages directly with these discussions.

2.2. Adaptation approaches and contributions to adaptive capacity

Approaches to adaptation can range from those that address specific climate impacts (e.g. sea level rise) to those that address broader drivers of vulnerability, such as poverty and economic inequality, often characterized as addressing resilience. Climate

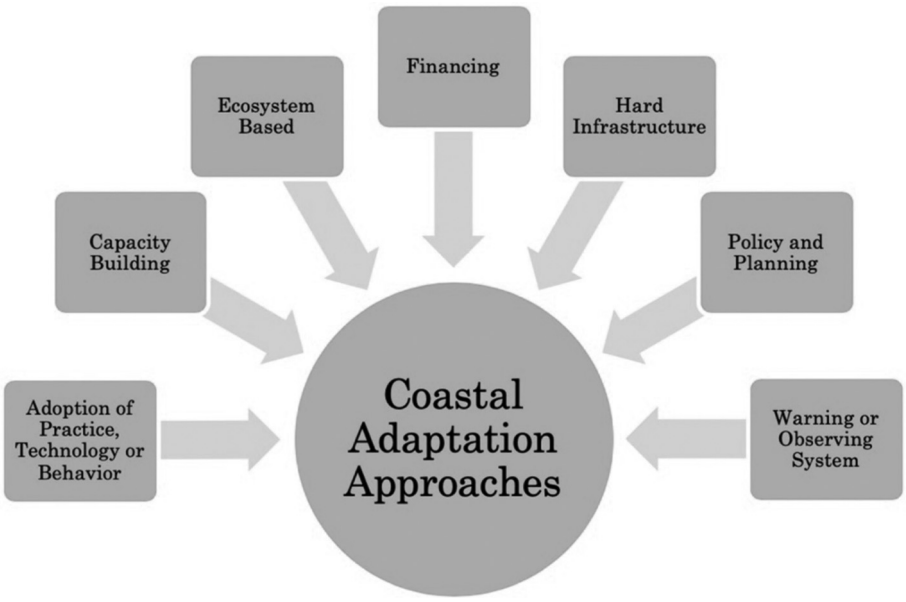

Fig. 1. Adaptation strategies can be categorized into different approaches, as described by Biagini et al. (2014). For the purposes of our analysis, the typology was simplified slightly by combining the categories of adoption of practice and behavior and technology, and policy with management and planning, and removing the category "information" (as all information instances were concurrent with either capacity-building or warning or observing system approaches). We also renamed the category "green infrastructure" as "ecosystem-based adaptation."

change presents a risk to development progress, and many of the advances in the past decade could be stalled or even reversed unless urgent action is taken to adapt (IPCC, 2018). A recent World Bank report found that climate change could push more than 100 million additional people back into poverty by 2030 without adaptation efforts (Hallegate et al., 2016).

Despite the acknowledgement that adaptation and development are closely linked, certain characteristics of the global adaptation finance landscape suggest that there may be biases towards adaptation strategies that address specific climate impacts rather than those that focus on broader approaches to resilience (Afful-Koomson, 2015; McGray, Hammill, & Bradley, 2007; Remling & Persson, 2015; Sherman et al., 2016). Researchers caution that this may have unintended negative consequences for adaptation (Dilling, Daly, Travis, Wilhelmi, & Klein, 2015). Most notably, requirements to demonstrate the "additionality" of the project, or the "adaptation rationale" of a project may lead to a stronger emphasis on strategies on the climate-impacts end of the adaptation continuum.

One way to analyze adaptation across this continuum from broad resilience efforts to specific climate impact approaches is by considering contributions of different activities to building adaptive capacity. Adaptive capacity refers to the ability to respond to both sudden shocks and more gradual changes, including climate change as well as other types of shocks and stresses (Marshall & Marshall, 2007; Marshall et al., 2013). While earlier work has emphasized the value of an adaptive capacity framework broadly (Gallopín, 2006; Pahl-Wostl, 2009; Smit & Wandel, 2006), more recent work adds the complexity of considering the *types* of adaptive capacity that different adaptation strategies support (Eakin, Lemos, & Nelson, 2014; Lemos, Lo, Nelson, Eakin, & Bedran-Martins, 2016). These studies have demonstrated that some adaptation interventions build capacity to address specific climate impacts, while others focus on more generic adaptive capacity. In a framework developed by Eakin et al. (2014), generic adaptive capacities are conceptualized as addressing deficiencies in basic human development needs, while specific adaptive capacities address the "tools and skills needed to anticipate and effectively respond to specific (climatic) threats" (Eakin et al., 2014). The framework posits that successful and sustainable adaptation requires support to both generic and specific adaptive capacity. Under conditions with low specific and generic adaptive capacity, poverty traps can be expected. If only generic adaptive capacity is built, it can lead to a "safe development paradox," and if only specific adaptive capacity is built, it can lead to a "safety first" scenario (Eakin et al., 2014).

This conceptualization of adaptive capacity emphasizes the importance of investments across a broad range of adaptation strategies because some strategies are more likely to contribute to specific adaptive capacity and others to generic adaptive capacity. For example, certain adaptation strategies are more technology-dependent than others. These technological approaches are closely related to more specific adaptive capacity, suggesting that certain more technologically-oriented adaptation strategies may only be contributing to building specific capacity or otherwise leaving gaps across the full range of adaptation approaches. The value of building specific adaptive capacity is clear, but by addressing one specific impact, such approaches may create a false sense of security or create lock-in to certain solutions (Dewulf, 2013; Feola, Agudelo Vanegas, & Contesse Bamón, 2015; Inderberg et al., 2014; Kandlikar & Risbey, 2000; Kates, Travis, & Wilbanks, 2012; Klein, 2011; O'Brien & Leichenko, 2000; Park et al., 2012). Adaptation strategies that focus only on specific adaptive capacity may also support incremental improvements to existing livelihoods rather than necessarily addressing underlying vulnerabilities. Adaptation is deeply entwined with issues of vulnerability, power, and human security, and as such, any serious examination of adaptation necessarily confronts these issues and requires engagement with the structure and patterns of society that contribute to vulnerability and resilience (Arts & Tatenhove, 2004; Béné et al., 2017; Blythe et al., 2018; Coirolo & Rahman, 2014; Nagoda & Nightingale, 2017). Strategies that focus on underlying drivers of vulnerability are equally important for adaptation. By addressing specific climate impacts, as well as building generic adaptive capacity or resilience, adaptation efforts can contribute to better development outcomes.

3. Methods

The study is based on a content analysis of project proposal documents for coastal adaptation projects funded through UNFCCC financial mechanisms. Based on the typologies described above, we analyzed approaches to adaptation in each project as well as whether those projects contributed to generic or specific adaptive capacity.

3.1. Sample selection

This analysis focused on the four climate funds that serve as the financial mechanisms of the UNFCCC: the Least Developed Country Countries Fund (LDCF), the Special Climate Change Fund (SCCF), the Adaptation Fund (AF), and the Green Climate Fund (GCF). The LDCF and SCCF, both managed by the Global Environment Facility (GEF) are some of the earliest dedicated adaptation funds, established in 2001. The LDCF funds concrete adaptation projects exclusively in the 48 Least Developed Countries. The SCCF is open to all developing countries and focuses broadly on technology transfer and mitigation, in addition to climate change adaptation. The AF was established under the Kyoto Protocol in 2007, and its role under the Paris Agreement was affirmed in Katowice in 2018. In addition to voluntary contributions, two percent of the contributions collected by the Clean Development Mechanism under the Kyoto Protocol were funneled to the AF to implement concrete adaptation projects in developing countries (Horstmann, 2011). The newest financial mechanism, the GCF, became fully operational in 2015. The GCF is funded by grants, loans, and capital from contributing countries. While these are critical financial mechanisms, they represent a small fraction of the broader adaptation finance landscape. UNEP's analysis of adaptation finance for 2015 found that only 3% of finance came through dedicated climate funds, or 750 Million USD, while the remainder came from development finance institutions and domestic governments (Olhoff, Bee, & Puig, 2015). Since then, funding from multilateral climate funds has actually fallen slightly, although this is expected to change as the GCF ramps up funding (UNEP, 2018).

Across the portfolio of the four funds, 354 adaptation projects had been approved at the time of analysis (through September 2017). For this analysis, we identified all projects with coastal components for inclusion in the sample. Coastal projects were identified based on keywords in the project title and Project Results Framework for each project. Keywords included terms related to coastal adaptation or coastal impacts such as: "coastal," "marine," "fisheries," "mangroves," "hurricane/cyclone," "salt water intrusion," "flooding/floods," "erosion," and "salinity" or any other terms that could signify a coastal emphasis for the project. After identifying potentially relevant projects, all project descriptions were reviewed to assess their relevance. The geographic coverage of the project was also reviewed to verify if it addressed coastal issues. Projects using terms such as "flooding/floods" and "erosion" were particularly carefully reviewed, as these terms often applied to inland flooding and erosion and not coastal issues. We excluded projects that had not advanced to the full proposal stage, as project design was often revised substantially between the concept note phase and the full proposal stage of design. After review, we identified 71 projects with a full proposal that had a coastal component. Full proposal documents were downloaded from the online databases of each fund. In the case of missing documents, a google search was conducted to identify final versions that had not been properly uploaded to the fund websites. UNDP, the largest implementer across the portfolio, also provided several project proposals directly. After these measures, we were unable to access eleven project proposal documents, leaving a final sample of 60 projects for analysis (Table 1). For further details on the projects, see Supplemental material.

The majority of projects were financed from the GEF-managed funds (70%). Twenty-three percent of projects were funded through the AF, and the remaining 7% of projects from the GCF. A total of 39 countries were included in the sample, as well as two regional projects. There was wide variation in the regional distribution of projects, with 21 projects in sub-Saharan Africa, 18 projects in East Asia and the Pacific, 8 in both Latin America and the Caribbean and South Asia, 4 in the Arab States and only 1 in Eastern Europe and Central Asia (Fig. 3). For a full list of countries, please see Fig. 3 and Supplemental material. The sample includes projects

Table 1
Coastal projects in each of the 4 funds were identified from the full portfolio of projects. Among coastal projects, 11 projects were excluded because the project proposal documents were not available, leaving a total of 60 projects in the final sample. A complete list of projects can be found in Supplemental material.

	LDCF	SCCF	AF	GCF	Total
Total adaptation projects	191	67	66	30	354
Total coastal projects	40	13	14	4	71
Excluded – document unavailable	8	3	0	0	11
Total project documents analyzed	32	10	14	4	60

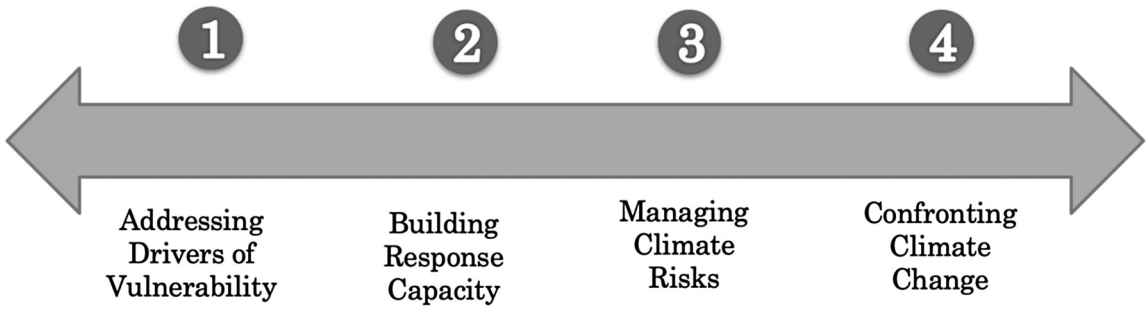

Fig. 2. Adaptation can be understood as falling along a continuum from development-oriented interventions to interventions focused on climate impacts, with implications for the type of adaptive capacity built from different adaptation interventions. (Adapted from McGray, Hammill, & Bradley, 2007).

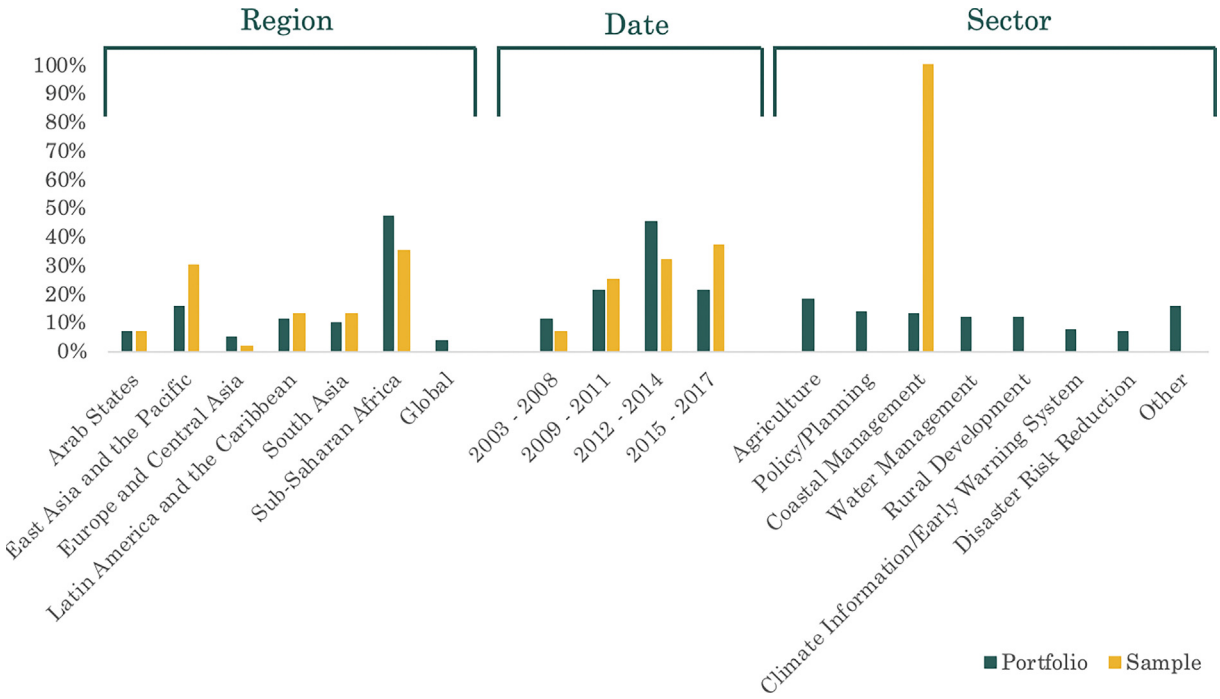

Fig. 3. The sample of coastal adaptation projects from the LDCF, SCCF, AF and GCF compared to the full portfolio of projects in these funds. For the purpose of this analysis, the UN regions as used in the Human Development Reports are utilized. The full list of countries included in each region can be found here: http://hdr.undp.org/en/content/developing-regions. Countries included in the sample included: Albania, Angola, Antigua and Barbuda, Bangladesh, Belize, Cambodia, Cook Islands, Cuba. Democratic Republic of Congo, Djibouti, Egypt. Guinea, Guyana, Haiti, India, Kiribati, Liberia, Madagascar, Maldives, Mauritius, Micronesia, Morocco, Mozambique, Papua New Guinea, Peru, Samoa, Sao Tome and Principe, Senegal, Seychelles, Sri Lanka, Tanzania, Thailand, The Gambia, Timor Leste, Togo, Tunisia, Tuvalu, Vanuatu, Vietnam. In addition to national projects, the sample included two regional projects: one in the Caribbean and one in the Pacific.

approved as early as 2007 and as recently as 2017, although there are relatively few projects in the early years. Projects were divided into four time periods, each of three years (with the exception of the first time period, due to the limited number of projects in the early period). Most countries only had an investment in one coastal project, though there are some exceptions. It is also interesting to note that many coastal countries have not received any funding for coastal projects from these funds (although they may have received adaptation funding for other priorities).

We compared the regional distribution and starting dates of the 60 projects in our sample to the characteristics of the full portfolio of adaptation projects that have been funded (Fig. 3). Overall, the coastal projects are fairly similar to the broader portfolio, although there is a slight under-representation of sub-Saharan Africa and an over-representation of East Asia and the Pacific, which is to be expected given geographic differences and relative prioritization of coastal adaptation by region (i.e. there are more landlocked countries in Africa, so it is not surprising that there are fewer coastal projects in this region. Similarly, there are many Small Island Developing States in East Asia and the Pacific, so a higher representation of coastal projects from this region is expected). From this graph you can also see that coastal management projects are fairly evenly represented in the portfolio along with other priority sectors including agriculture, policy/planning, water management, and rural development.

The sample of projects addressed multiple adaptation issues and utilized a wide range of adaptation approaches. Almost half (28 projects or 47%) were in island nations, with the remainder in coastal nations. Some projects addressed multiple hazards and were more focused on the adaptation process, while others were designed to address specific issues. Thirty projects focused on coastal zone management, 6 on agriculture, 6 on early warning systems, 6 on policy mainstreaming or creating an enabling environment, 5 on flood reduction, 3 on fisheries and aquaculture, 2 on securing potable water and 1 on urban adaptation.

3.2. Content analysis

The project designs of the coastal adaptation projects were analyzed to identify 1) which approaches to adaptation were included in each project, and 2) contributions to specific and generic adaptive capacity. Approved project proposal documents were selected as the key data source. Content analysis of these documents was chosen as the methodology in this study because we sought to characterize specific aspects of project design which were described in the project proposal documents.

These publicly-available project documents represented the full proposal presented by an implementing agency to a funding agency and detailed how the funds would be used. Project proposals were between 70 and 150 pages long and consisted of a regional situation analysis, adaptation strategy, project results framework, monitoring and evaluation framework, and detailed project budget and work plan. Though the format of the project proposal varied depending on the funding source, all proposals contained a project results framework. The project results framework explicitly described the project's objectives, outcomes (sometimes referred to in proposals as components), outputs, and activities, and was used in our analysis as the primary means of comparing strategies across projects.

The project proposal documents were coded using the qualitative coding software NVivo. Each outcome was categorized based on the approach to adaptation that it employed, using the typology developed by Biagini et al. (2014), as described in Section 2. Outcomes were categorized as one of seven possible approaches: adoption of practice, behavior, or technology; capacity-building; ecosystem-based adaptation; financing; hard infrastructure; policy

and planning; and warning or observation systems. Outcomes were coded based on the text in the project results framework and the detailed project description for each outcome. A total of 213 project outcomes were coded across the 60 projects. Examples of the coding approach can be found in Supplemental material. The results were analyzed to determine the frequency of each approach across the portfolio as well as trends based on the year a project was approved and project region. The outcomes were qualitatively analyzed to identify themes within each of the seven approaches. The goal of this analysis was to better understand how projects were implementing each approach and what types of activities were included.

We also analyzed the contribution of all outcomes, outputs, and activities to building specific or generic adaptive capacity. Each outcome, output, and activity was coded as contributing to specific or generic capacity using the framework developed by Eakin et al. (2014) as described in Section 2. If the outcome, output, or activity referred to a specific climate impact, or explicitly described how it addressed climate change, it was coded as "specific adaptive capacity." Alternatively, if it referred to broader approaches that would build resilience and contribute to development, it was coded as "generic adaptive capacity." The content of the project descriptions for each outcome, output and activity was analyzed to determine which type of adaptive capacity was most appropriate. A total of 213 outcomes, 549 outputs, and 412 activities were coded. The descriptions of 8 outcomes, outputs or activities were too vague to categorize and were excluded from subsequent analysis. A number of project outcomes, outputs or activities did not lend themselves to a clear classification as either type of adaptive capacity. Some project components focused on creating an enabling environment for adaptation and could arguably set the stage for either specific or generic capacity-building but did not necessarily build adaptive capacity in their own right. Rather than excluding these, we coded them as "enabling" because they focused on building capacity or providing the data needed for policy or direct implementation. Some project components coded as enabling were related to project activities, such as learning and monitoring and evaluation. While each of these activities eventually contributes to adaptive capacity, we wanted to be able to distinguish between those activities that directly contributed and those that did so indirectly. One interesting theme that arose of particular relevance for coastal adaptation was restoration. We added a restoration category to be able to analyze these components specifically because restoration did not fit neatly into the conceptual framework as described by Eakin et al. (2014). The generic versus specific adaptive capacity distinction highlights the continuum within adaptation between climate-impact specific approaches and broader resilience and development approaches. Restoration activities, however, introduced another common continuum identified in the adaptation literature: between climate-impact specific approaches and broader conservation approaches. While it could be argued that these restoration activities could be coded as generic adaptive capacity, due to their broader role beyond climate change, we chose to code them separately in order to highlight this specific tension within adaptation.

3.3. Limitations

Our analysis is limited by the selection of project proposals as the primary data source. It is possible that certain approaches were either over or under-represented in proposal documents, but not at the implementation stage. While details of projects evolve over time and implemented projects may have deviated significantly from their proposed design, the project proposal document provided a standard picture of the project as agreed upon by the funding agency, and thus provided a meaningful representation of adaptation priorities. The results of this analysis, therefore, should be interpreted as an analysis of trends in the design of adaptation projects, not necessarily in terms of trends in the successful implementation of adaptation approaches. It would be quite interesting to follow the trajectories of the projects to identify if and how adaptation approaches changed over the course of project implementation.

4. Results and discussion

4.1. Approaches

Almost all projects (58 of the 60) included multiple adaptation approaches, demonstrating that the projects were designed to approach adaptation from more than one angle. Most projects included two or three approaches, although some included up to six. The co-occurrence of multiple adaptation approaches within projects, often operating at different scales, with some targeting national-level policy while others demonstrated specific practices in specific locations, indicates that in practice, adaptation to climate change is multi-scalar and dynamic, and that multilateral adaptation projects reflect this reality (Burnham & Ma, 2018; Fazey et al., 2015). This degree of complexity has important implications for project implementation, as it requires a sophisticated analysis of the ways that the various project components build on each other and necessitates coordination with many potential actors. It also makes these projects, which are relatively small in size in terms of funding, fairly complex to manage and may increase the administrative burden associated with implementation. At the same time, it was clear from the project proposals that the design of the projects was intended to reflect the complexity of the reality on the ground. Proposals articulated the ways in which different project components built upon each other and filled different gaps.

The two projects that utilized only one approach focused exclusively on warning and observing systems, suggesting that there may be something different about the way that climate information and early warning projects are conceptualized. At least in these projects, it appears that a warning and observing system approach was viewed by project designers as less reliant on other adaptation strategies. This suggests that it may be possible to conceptualize investments in warning and observing systems separately from more comprehensive adaptation project strategies.

Policy and planning was the most common approach, appearing in 45 of the 60 projects, followed by capacity-building, which was included in 39 projects, while warning and observing systems and financing were the least common, with only 10 and 8 projects respectively (Fig. 4). With 75% of projects including policy and planning as one of the approaches in their project design and 65% including capacity-building, these approaches were integral to adaptation project design. Typically, projects included policy and planning, capacity-building, and then one of the other five adaptation approaches. Apart from the 2 projects discussed above, all projects included at least one or the other, if not both. This suggests that policy and planning and capacity-building approaches create an enabling environment, which is crucial to implementing the other five, more tangible approaches. This finding echoes that of Nelson et al. (2007): "process and action are predicated on effective governance and management structure." As discussed in Section 4.2, activities within policy and planning included conducting assessments and developing institutional arrangements that would allow other adaptation approaches to be successful. Similarly, capacity-building activities often focused on training local leaders or community members on the relevance of climate adaptation, which was deemed a necessary precursor to,

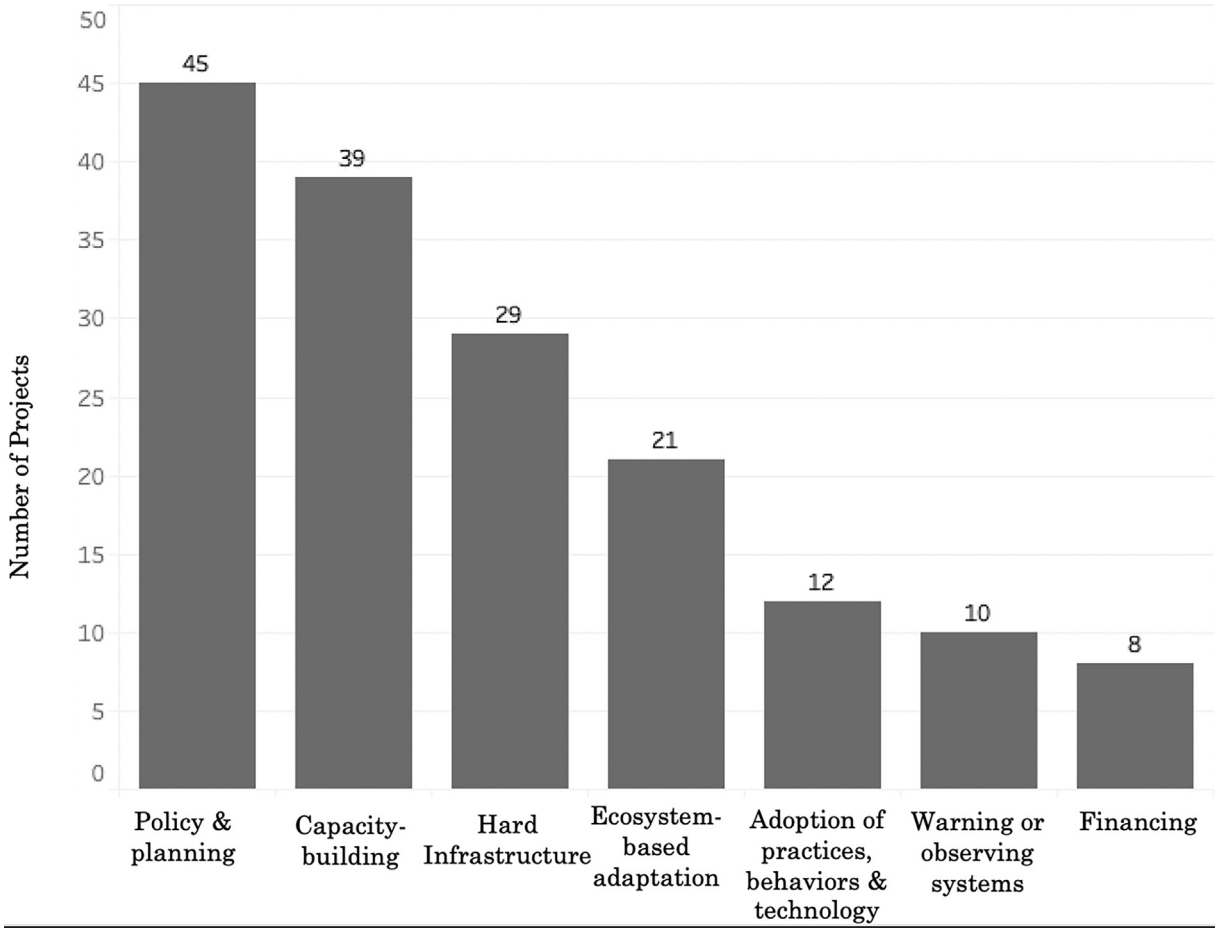

Fig. 4. The number of projects in which each approach to adaptation appeared across the portfolio of 60 projects is compared. Policy and planning and capacity-building were the most common approaches while warning and observing systems and financing were less common.

for example, technology adoption. The policy and planning, and capacity-building components, as many project proposals argued, were foundational for both 1) identifying the specific ways to implement the other proposed adaptation strategies (i.e. a planning exercise undertaken in Component 1 of a project might lead to the selection of specific locations of coastal defense strategies to be implemented in Component 2 or 3 of a project) and 2) ensuring the long-term sustainability and scalability of the concrete measures implemented in other components.

Over time the number of different approaches included in projects increased, indicating that projects were becoming more complex and projects were moving from the foundational activities of policy and planning and capacity-building to more concrete implementation measures (Fig. 5). During the first time period, from 2003 to 2008, only four of the approaches were included in project designs (policy and planning, capacity-building, hard infrastructure, and ecosystem-based adaptation). In the 2009–2011 time period, warning and observing systems and financing approaches were introduced in projects, although they did not become more frequent until the 2012–2014 time period. As is evident in Fig. 5, the dominance of policy and planning has declined over time as other approaches that build upon policy and planning have been added to project designs. Policy and planning approaches were included in 100% of projects in the first period but only 59% by the final period. However, even in current projects, the foundations of policy and planning and capacity building were still important and remained the most frequently-included strategies.

Analysis of trends over time must take into consideration that most countries only have implemented one coastal project from the UNFCCC adaptation funds. Therefore, while over time collectively there was evidence that projects were getting more complex, perhaps reflecting an increasingly sophisticated understanding of adaptation, most projects represented the first time a country was proposing a coastal adaptation project to these funds. At the same time, it is important to recognize that coastal adaptation projects did not occur in isolation and particularly at the policy level, adaptation projects in other sectors may have helped build the foundation for more direct adaptation approaches across sectors. Similarly, the UNFCCC adaptation funds are not the only source of adaptation finance, and it is possible that countries had invested in some of the foundational activities that dominated early projects through other sources of international or domestic finance. Therefore, it is not surprising that policy and planning and capacity building continued to be the most common approaches, but that their dominance declined as the adaptation landscape matured over the time-period under consideration.

In addition to changes over time, we analyzed the prevalence of approaches across regions, and compared islands with non-island nations. While the sample size was too small to allow for meaningful comparisons across regions (for example, there was only one project in the Europe and Central Asia region), a few noteworthy patterns did emerge. Ecosystem-based adaptation was less prevalent in the Latin America and Caribbean region compared to other regions. South Asia did not include any projects with a warning or observing system approach, and financing approaches were only included in 5% of projects in sub-Saharan Africa, despite being the region arguably most in need of financing support. This may reflect a different level of baseline capacity, as warning and observ-

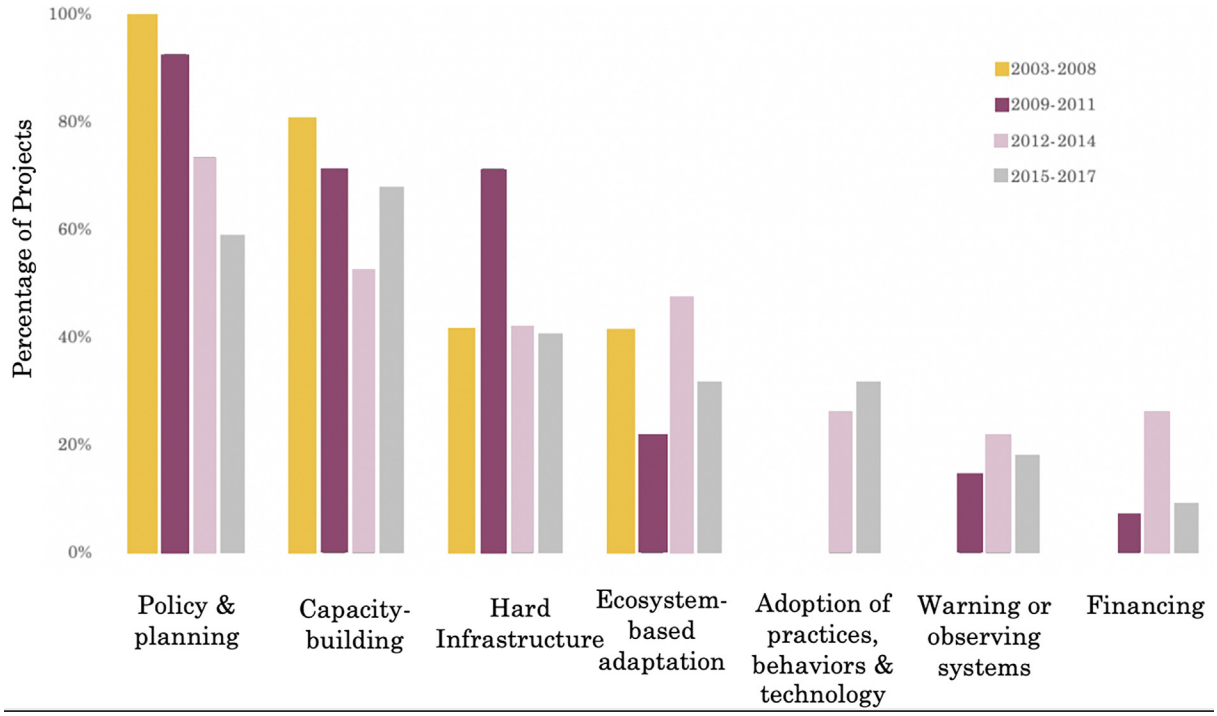

Fig. 5. The percentage of projects including each approach by time period: 2003–2008, 2009–2011, 2012–2014, 2015–2017 is compared. The decrease in the proportion of projects including policy and planning over time reflects the addition of new approaches that were not present in the first time period and the increasing emphasis on implementation of concrete adaptation measures.

ing systems build on existing data and monitoring capacity, and financial approaches are predicated on relatively strong institutional capacity. Another interesting pattern was that all but one of the projects in the Arab region included hard infrastructure approaches, although in the portfolio overall slightly less than half of projects included a hard infrastructure approach. These differences, while not conclusive, may point to differences in cultural preferences or priorities, or may reflect different physical, institutional or political contexts, and is an interesting area for further research. Our analysis did not find any differences based on being an island nation, but it is possible that differences did emerge in the implementation stage. See Supplemental Figs. 1 and 2 for the results of these analyses.

4.2. Themes within approaches

To better understand what kinds of activities were implemented within each approach, we analyzed the project components that utilized each approach to identify themes. These themes are described below and summarized in Tables 2 and 3.

4.2.1. Policy and planning

The most common approach, policy and planning also had the greatest diversity of actions. Within policy and planning, the most common theme, representing 35% of policy and planning outcomes, was the development of ecosystem-based policy, demonstrating close linkages between policy and planning and ecosystem-based adaptation. The prevalence of this approach also suggests that for ecosystem-based policy was not commonly in place before the projects, but that it resonated well with project designers. Actions to revise existing policy to include adaptive coastal zone management and mainstream climate change into existing policies was the next most common theme, with 30% of policy and planning outcomes falling under this theme, and an additional 9% specifically incorporating climate and disaster risk management into development planning. Approaches focusing on modifying existing policy suggest that project designers viewed adaptation as an issue beyond the domain of any single department or Ministry, and that success of the projects required integration across many policy domains. While these activities may not have led to tangible adaptation investments in the course of the project, proposals clearly articulated that these integrative activities were paving the way for the long-term sustainability and local ownership of adaptation efforts. Although less common, a few projects focused on developing specific sectoral policy, such as fisheries (9%) or tourism policy (4%). The relative infrequency of these targeted policy efforts may reflect the fact that most projects were designed as broader initiatives, and only a few targeted specific sectors in isolation.

Many policy and planning outcomes required the collection of data in order to complete pre-investment assessments, and 14% of policy and planning outcomes focused on either collecting data or completing assessments. Although there are some concerns that too many resources have been spent conducting vulnerability assessments and not enough resources have gone to implementation (Miller & Bowen, 2013; Mimura, Pulwarty, Duc, Elshinnawy, Redsteer, Huang, Nkem, & Sanchez Rodriguez, 2014; Remling & Persson, 2015; UNEP, 2018), project proposals strongly articulated the need for investments in data collection and vulnerability assessments as a prerequisite for effective implementation of adaptation action. In fact, many of the projects explicitly linked the outputs of these activities to other project components that were more focused on concrete adaptation measures.

4.2.2. Capacity-building

Like policy and planning, capacity-building was a common approach, present in 65% of the projects analyzed (Fig. 4). Themes within the capacity-building approach were wide-spanning. Some outcomes focused on improving capacity within the project itself, such as outcomes to manage project knowledge, evaluate its suc-

Table 2
Themes, theme descriptions, and theme examples of outcomes coded as Policy and Planning and Capacity Building Approaches.

Approach type	Themes	Description	Examples
Policy and planning	Ecosystem based policy	Institute new policy measures, planning, and regulations to protect marine and coastal ecosystems explicitly	Supporting the management of the selected MPAs including replenishment zones (Belize.AF.WB)
	Policy revision	Improve existing policy to mainstream or promote adaptive measures at a national level	Revised policies and plans – particularly local area development plans – that promote and facilitate medium- and long-term adaptation to climate change. (Antigua and Barbuda. SCCF.UNEP)
	Pre-investment assessment	Undertake assessments and climate studies to inform modeling, engineering, decision-making, and policy	Pre-feasibility studies for coastal lowland interventions (Guinea.LDCF.UNDP)
	Development planning	National and local integration of disaster risk management, climate risk considerations, and ecosystem-based adaptation into development planning	Undertake a gap analysis of national development plans and policy to determine the extent to which climate change risks are included (Cambodia.LDCF.UNEP)
	Fisheries governance	Inclusion of climate change adaptation in fisheries regulation	Relevant national policies and strategies reviewed (gaps analyzed) and revised by incorporating fisheries and aquaculture adaption to climate change (Bangladesh.LDCF. FAO)
	Tourism policy	Inclusion of climate change adaptation in tourism related policy	Policy recommendations developed to enable and incentivize private sector investment for climate change adaptation in the tourism industry (Maldives.LDCF.UNDP)
Capacity building	Manage project knowledge	Capture and disseminate lessons learned to facilitate project replication and institutionalize best practices	Project monitoring system operating providing systematic information on progress in meeting project outcome and output targets (Bangladesh.LDCF.UNDP)
	Individual and community capacity building	Increase ability to identify, implement, operate, and manage adaptive strategies, as well as increase risk management and disaster preparedness at a local or regional level	Community consultations on each target island ensure participative design, sustainability and continued maintenance of integrated water resource management schemes (Maldives. LDCF.UNDP)
	Increase awareness	Institutional and individual education on climate change risks, impacts, and vulnerabilities in order to encourage ownership and advocacy of adaptation projects	Climate change awareness and education programmes carried out to build next generation' resilience to climate change (Papua New Guinea.AF.UNDP)
	National and institutional capacity building	Increase inter-ministerial coordination, mobilization, and organization in order to respond to and reduce climate change risks at a governmental level	Training provided to the Secretariat of the Inter-ministerial Committee for Biodiversity and Climate Change and Climate Change Cabinet (Angola.LDCF.UNDP)
	Technical capacity building	Increase ability to predict, and respond to the effects of climate change by increasing technical capacity and creating monitoring and evaluation systems for adaptation projects	Strengthened capacity of aquaculturists in climate change adaptation measures and adaptive technologies (Caribean. SCCF.FAO)

cess, and capture lessons learned to enhance overall adaptation capacity beyond the project life-span (Table 2). These outcomes represented 25% of the capacity-building outcomes. Although some would argue that these activities represent project management and are an administrative cost of the project, given the role that projects were playing as demonstration or pilot projects, the necessary capacity often was not present in the country and needed to be built. Proposals articulated how investments in internal capacity were essential to the success of the project and would help ensure that the impact of the project expanded beyond the life-span and geographic coverage of the project. Capacity-building outcomes spanned from the individual or community level (18%) to the national or institutional level (13%), and included training for individuals, communities, local NGOs, local government, or national ministries on a wide range of topics, with climate-resilient technologies and climate risk management being some of the most common. An additional 10% of capacity-building outcomes focused on increasing technical capacity to implement actions introduced through other approaches. In addition to specific trainings, other outcomes were designed to increase awareness of climate change at both the national and local levels, representing 17% of capacity-building outcomes. In contrast to the trainings, awareness-raising outcomes were more diffuse, targeting a broader segment of the population with basic knowledge of climate change rather than building capacity around specific adaptation solutions. Knowledge is a key component of adaptive capacity, and without the awareness and knowledge of climate impacts and potential options, actors may not mobilize existing adaptive capacity to adapt to climate impacts (Eakin et al., 2014; Whitney et al., 2017). The range of capacity-building initiatives included in projects, from internal project capacity-building, to training at the individual, community, and government levels, to broader civic awareness-raising, highlights the breadth of the adaptation challenge in coastal contexts.

4.2.3. Hard infrastructure

Infrastructural approaches were present in 29 of the projects analyzed, making it the most common approach after policy and planning and capacity-building (Fig. 4). Infrastructure outcomes primarily addressed specific climate vulnerabilities, with flooding, coastal erosion, and salination being the most frequent climate impacts that infrastructural approaches addressed (Table 3). Embedded within this approach were two ways that infrastructure was conceptualized: sometimes the action focused on protecting infrastructure itself (climate-proofing it), and other times hard infrastructure was proposed as a solution to protect other assets from climate impacts. Although some projects identified specific climate impacts they were responding to, almost two thirds (63%) of the actions within the hard infrastructure approach did not identify a specific impact, but rather only stated "coastal impacts" or "climate impacts." For example, project outcomes included: "vulnerability of physical assets and natural systems reduced" (Cambodia, LDCF, UNEP) or "addressing climate change impacts on key infrastructure and settlements" (Tanzania, AF, UNEP), acknowledging that infrastructure was threatened but not identifying how. While common, infrastructural approaches did not dominate the adaptation approaches in this portfolio, but a broader assessment of adaptation finance conducted by UNEP, suggests that the majority of adaptation investments by the multilateral development banks, which manage significantly larger funds, currently use infrastructural approaches (UNEP, 2018). Given that other funds are investing in traditional infrastructural approaches,

Table 3
Themes, theme descriptions, and theme examples of outcomes coded as Hard Infrastructure, Ecosystem Based, Warning or Observing System, Adaptation of Practice, Behavior, or Technology, and Financing Approaches.

Approach type	Themes	Description	Examples
Hard Infrastructure	Flooding	Reduce exposure of coastal communities, productive systems, and transportation infrastructure to flooding	Construct and rehabilitate gabion walls to protect urban areas in Tadjourah from flooding (India.SCCF.AsDB)
	Erosion	Reduce threat of effects of erosion to coastal communities' land, housing, economic hubs, and cultural infrastructure	Building up of the coastal protection facilities in the areas of Rufisque. The target area host houses, economic and cultural infrastructure (Senegal.AF.CSE)
	Salinization	Reduce risk of salt-water intrusion on fresh water resources through rehabilitation of aquifers	Artificial groundwater recharge systems established to protect groundwater resources from salinization and improve aquifer yields in dry seasons (Maldives.AF.UNDP)
Ecosystem based approach	Enhance natural buffers	Conserve and restore mangroves and other coastal ecosystems for their goods, services, and intrinsic value	Ecosystem-based coastal protection through mangrove system restoration (Cambodia.LDCF.UNEP)
	Ecosystem management to increase community resilience	Integrate ecosystem-based land management to reduce vulnerability of communities along coasts	Ecosystem-based Adaptation Management Operational through implementation of national guidelines for ecosystem-based adaptation. (Kiribati.LDCF.UNDP)
Warning or observing system	Hydro-Meteorological Data Collection and Monitoring Systems	Install or upgrade weather-monitoring systems and apply proper data collection methods	A comprehensive data base and data management system is established and centralized (Gambia.LDCF.UNEP)
	Weather and Climate Information Delivery and Integration	Ensure data gathered are disseminated effectively to relevant stakeholders and information used to inform climate models and policy-making	A system to produce and disseminate agro-meteorological information has been designed and put into service (Madagascar.LDCF.UNDP)
	Improve Response Time	Improve preparedness of stakeholders for hydro-meteorological events	Raised awareness and preparedness of outer island communities for climate-induced extreme events (Tuvalu. LDCF.UNDP)
Adoption of practice, behavior, and technology	Climate resilient and sustainable livelihoods	Support for alternative livelihoods that conserve marine resources as well as prevent fisheries collapse from an economic and nutritional perspective.	Increased, diversified and resilient livelihoods from the introduction of sustainable alternative economic development activities (Djibouti.LDCF.UNEP)
	Adoption of adaptation technology	Technology and behaviors adopted by communities to increase fresh water security, conservation, and management	Climate resilient agro-sylvopastoral, fishery and water management technologies, and advisory support services for resilient agricultural practices have been disseminated to 3000 producers from the most vulnerable communities (of which 40% are women) in 11 pilot communes of the Androy, Anosy, Atsimo Andrefana, Analamanga and Atsinanana regions (Madagascar.LDCF.UNDP)
Financing	Transfer of funding responsibility	Implement and manage adaptation funds at the national and village level	NGOs and village governance structures – have enhanced capacity to manage climate finance. (Samoa.LDCF.UNDP)
	Establish financing mechanisms	Sustainable and innovative financing mechanisms to address long-term climate change adaptation efforts established	Investment mechanisms for community based coastal adaptation developed and initiated in both project regions with participation of key tourism operators (Djerba) and farmers (Northwest of Gulf of Tunis) (Tunisia.SCCF.UNDP)

perhaps an effective use of multilateral climate funds would be to invest in ecosystem-based approaches that provide similar functions (Sutton-Grier et al., 2018).

4.2.4. Ecosystem-based

Twenty-one of the projects included an ecosystem-based approach (Fig. 4). The ecosystem-based approach included recovery, enhanced resilience, or management of ecosystems that provide natural barriers to the effects of climate change, recognizing the potential of ecosystems to provide protective services and co-benefits. For instance, a recent study revealed that global flood damages from 100-year storms would be 91% greater without the protective value of coral reefs, estimated at $272 billion USD (Beck et al., 2018). From our analyses, projects involving ecosystem-based approaches were evenly split (50/50) between mechanisms to enhance the resilience of natural habitat buffers and ecosystem management to enhance the adaptive capacity of coastal communities to the effects of flooding, sea level rise and other climate related risks (Table 3). These two strategies reflect both the protective role of ecosystems and the services that ecosystems provide. Many projects specifically focused on mangroves, although some projects addressed coral reefs as well. Project proposals often highlighted the natural habitat present in the country as an asset that adaptation strategies could build upon, presenting a more positive perspective on adaptation compared to other narratives that focused more on vulnerability. Several proposals also discussed the interconnections between the natural environment and human livelihoods, using a socio-ecological systems framework to conceptualize the system and the potential adaptation solutions (see for example Collins et al., 2011).

That there were only two underlying themes within the ecosystem-based approach suggests that this approach has been conceptualized in a more limited (or consistent) way compared to other approaches like hard infrastructure. In contrast to the breadth of policy and planning and capacity-building, the proposals for ecosystem-based adaptation were much more targeted in specific geographic areas. They also were more likely to focus on measurable results within the timespan of the project, while also recognizing that many of the benefits of ecosystem-based adaptation might not materialize in the short-term. The socioeconomic context and benefits of coastal restoration activities, such as mangrove conservation and reforestation, are understudied and underfunded compared to agriculture and forestry contexts (Das, 2017; Whitney et al., 2017), but the inclusion of these approaches in this portfolio may allow for greater awareness and opportunities for study in the future. Given the rising interest in nature-based solutions to climate change and the significant potential for synergies with mitigation, it is likely that the prominence of ecosystem-based adaptation strategies will increase in the future and that the dominance of these approaches will continue to increase (Beck et al., 2018; Narayan et al., 2016).

An interesting question is whether projects were combining hard infrastructure and ecosystem-based approaches, or whether these two approaches were considered substitutes. Of the 42 pro-

jects that included either an infrastructural or ecosystem-based approach, only 8 projects (19%) included both. This suggests that in most cases, project designers viewed hard infrastructure approaches and ecosystem-based approaches as substitutes. Looking more closely at the 8 projects that utilized both approaches, several interesting themes emerged. One project in Tanzania, funded through the AF, explicitly talked about blending hard and soft coastal protection measures, stating that the ecosystem measures were designed to maximize the efficiency of the hard infrastructure components. A project in Samoa funded by the LDCF also explicitly discussed the combined use of hard and soft protection measures, placing this within the context of an integrated "Ridge to Reef" approach to adaptation that included protection of community assets such as housing and water and sanitation as well as watershed conservation strategies. Other projects did not make this combination explicit, and typically included a component focused on mangrove restoration or rehabilitation and another on hard infrastructure (including flood-proofed housing design in Vietnam in a GCF-funded project and agricultural infrastructure such as dykes in a project in Cambodia funded by the LDCF).

4.2.5. Adoption of practice, behavior, and technology

Twelve projects included the adoption of practice, behavior, and technology as an adaptation approach (Fig. 4). The majority of outcomes (62%) within this approach focused on building alternative livelihoods for resilient local economies. The most specific alternative livelihood mentioned within these outcomes was aquaculture. Other outcomes were more general, describing "resilient fisheries" or "sustainable bio-business." Frequently the need for these alternative livelihoods was described in terms of "allowing for the recovery of over-harvested fisheries," suggesting that that a broader resilience objective rather than a specific climate rationale may have motivated many of these actions. Returning to the adaptation continuum introduced in Fig. 2, the project components employing this approach were more likely to be closer to the "reducing vulnerabilities" end of the spectrum, compared to other approaches that were designed to respond more explicitly to specific climate impacts. The other theme within this approach was the adoption of adaptation technologies, again, strongly linked to more sustainable technologies for fishing, although there were several instances of introduction of agricultural technologies as well. Components focusing on the adoption of adaptation technologies emphasized the novelty of these technologies to users, rather than their novelty overall, a finding consistent with the literature on technology transfer for adaptation (Biagini, Kuhl, Gallagher, & Ortiz, 2014; Kuhl, 2019).

4.2.6. Warning or observing system

Activities in the warning or observing system approach addressed the installation, upgrading, monitoring, or delivery of hydro-meteorological technology and information (Table 3). This approach was present in 10 of the 60 projects (Fig. 4), but those projects that included warning and observing systems tended to invest significant resources in them. In fact, the only two projects that did not include multiple approaches were projects focused on warning and observing systems. Applications of warning and observing system approaches can provide invaluable weather-related information that increases the accuracy of weather monitoring, sea level rise estimates, and the efficacy of disaster evacuation planning (Mackay et al., 2019; Rasmussen, Kirchhoff, & Lemos, 2017; Singh et al., 2018). The three themes in the warning or observing system approach formed a logical progression from installation, delivery, and use of weather and climate data. Although some components of these systems may help build the foundation for long-term climate projections and adaptation planning, most activities were focused on short-term weather data and immediate early warning systems, or in other words, disaster risk management. Disaster risk reduction and disaster risk management are an important part of a comprehensive adaptation strategy, and their importance for coastal communities is undeniable, but similar to debates about whether adaptation finance should be used to build broader resilience, the relationship between adaptation finance and disaster risk reduction is contested (Aldunce, Beilin, Howden, & Handmer, 2015; Hall, 2017; Schipper & Pelling, 2006; Thomalla, Downing, Spanger-Siegfried, Han, & Rockström, 2006). It is also interesting to note that compared to other approaches, warning and observing system approaches tended to be less integrated with other adaptation approaches. There was some integration with policy and planning approaches, particularly in terms of the role of climate information for risk and vulnerability assessments, but less articulation of connections between warning and observing approaches and other approaches.

4.2.7. Financing

Although only 13% of the projects included a financing approach, a long-term strategy for financing adaptation is critical to the sustainability of adaptation initiatives, as acknowledged by those projects that included a financing approach. Financing outcomes fell into two primary categories: actions focused on developing institutional capacity to manage climate finance and those focused on establishing financial mechanisms (Table 3). Although many of the UNFCCC-financed adaptation projects were implemented through multilateral institutions (UNDP was the implementing partner for approximately half of the projects), there are increasing efforts to provide "direct access" for local institutions to global adaptation funds, as exemplified by the direct access funding windows in the AF and GCF. However, significant institutional capacity is required for these institutions to access funding directly. Many proposals explicitly acknowledged that currently domestic institutional capacity to either apply for or manage large-scale funding did not exist. Balancing the need of global financial mechanisms to ensure accountability and fiscal management with the need for local ownership and the urgency of adaptation is a significant challenge (Bracking, 2015; Persson & Remling, 2014; Winkler & Dubash, 2016), and the proposals that included a financing component addressed this explicitly. In addition, there is widespread acknowledgement that international finance can only cover a fraction of adaptation costs and local financial mechanisms will cover the majority of costs (UNEP, 2018). In recognition of this reality, several projects were proposing pilot programs designed to mobilize broader sources of finance. As global estimates of the costs of adaptation continue to increase and the nascent field of adaptation finance continues to develop, this is an adaptation approach that can be expected to increase.

4.3. Contributions to adaptive capacity

The ultimate goal of all of the approaches discussed above was to build the adaptive capacity of individuals, communities and nations. Although they shared this overarching goal, depending on how adaptation was conceptualized, adaptation strategies may focus on building different types of adaptive capacity—either specific capacity to manage climate impacts or generic capacity that supports broader resilience.

Based on our analysis of the contributions in the portfolio of UNFCCC-financed coastal adaptation projects, most actions (outcomes, outputs, and activities) focused on building specific capacity (e.g. 61% of outcomes compared to only 10% of outcomes contributing to generic capacity). Overall, this suggests that investments made through the UNFCCC adaptation funds were very closely designed to address climate impacts. Depending on your perspective on the goals of adaptation finance, this could be con-

sidered a positive finding, or it could suggest that there is an imbalance in the investments (Sherman et al., 2016; Stadelmann, Roberts, & Michaelowa, 2011; Winkler & Dubash, 2016). Potential concerns that adaptation investments are not targeting climate change and adaptation finance is being used to address baseline development challenges appear unwarranted in this portfolio. On the other hand, if as Eakin et al. (2014) argue, sustainable adaptation requires both generic and specific adaptive capacity, the balance in this portfolio may be off.

While over 70% of actions were categorized as building either specific or generic adaptive capacity, 26% of outcomes (and 31% of outputs and 9% of activities) were more focused on creating an enabling environment, and could arguably set the stage for either specific or generic capacity building, and thus were categorized separately as enabling activities. As discussed in Section 3.2, we found that some actions did not fit neatly into either category, including those associated with monitoring and evaluation, learning, and providing data for the policymaking process. These actions highlight the important role of creating an enabling environment at all scales: internally to the project, ensuring the project's success, to more broadly, laying the foundation for long-term sustainable adaptation.

In addition to enabling activities, a final category of actions did not fit the specific versus generic categorization, and as described in Section 3.2, we coded these as restoration actions. Although a very small percentage of total actions (2.4% of outcomes and 5% of outputs), restoration actions played an important role in the adaptation discourses presented in project proposals. Instead of the continuum from development to adaptation that the majority of actions fell under, restoration actions captured a similar tension that exists between conservation-focused and climate impact-specific approaches to adaptation. Restoration actions were identified in both ecosystem-based and hard infrastructure approaches and used logics and narratives that spanned both a conservation-focused (nature-first) approach and a climate-impacts focused (human-first) approach (Fig. 6). When considering ecosystem-based approaches to adaptation, the adaptive capacity framework could be expanded to not only distinguish across the development-climate impacts continuum, but also within the environmental conservation-climate impacts continuum. For instance, the emphasis on conservation or reforestation of mangrove ecosystems and changes to fishery policy could be used to improve the sustainability of fisheries and identify synergies between conservation goals and adaptation goals. Additionally, because project proposals included restoration approaches in both the ecosystem-based adaptation and hard infrastructure approaches, it may be a strategy with the ability to act as a "bridge" between these two approaches that are frequently conceptualized as alternatives to each other.

In addition to looking at the contributions to specific and generic adaptive capacity across the entire portfolio, we analyzed whether various approaches showed different patterns. Most actions using hard infrastructure, ecosystem-based adaptation and warning or observing system approaches contributed primarily to specific adaptive capacity, suggesting that as adaptation investments become more concrete, the specificity of their contributions to adaptive capacity also increase. Despite the fact that the capacity-building approach was the strongest contributor to generic capacity, followed by policy and planning, for both approaches, a much higher proportion of outcomes contributed to an enabling environment. Given the prevalence of policy and planning and capacity-building approaches in the portfolio and the nascent stage of coastal adaptation planning, it is not surprising that many activities were creating an enabling environment for building adaptive capacity rather than building it directly. As can be seen in Fig. 7, policy and planning and capacity-building approaches contained most of the enabling activities, reinforcing the finding discussed in Section 4.1 that most projects paired more tangible approaches with policy and planning or capacity-building approaches. Since more recent projects included fewer outcomes using policy and

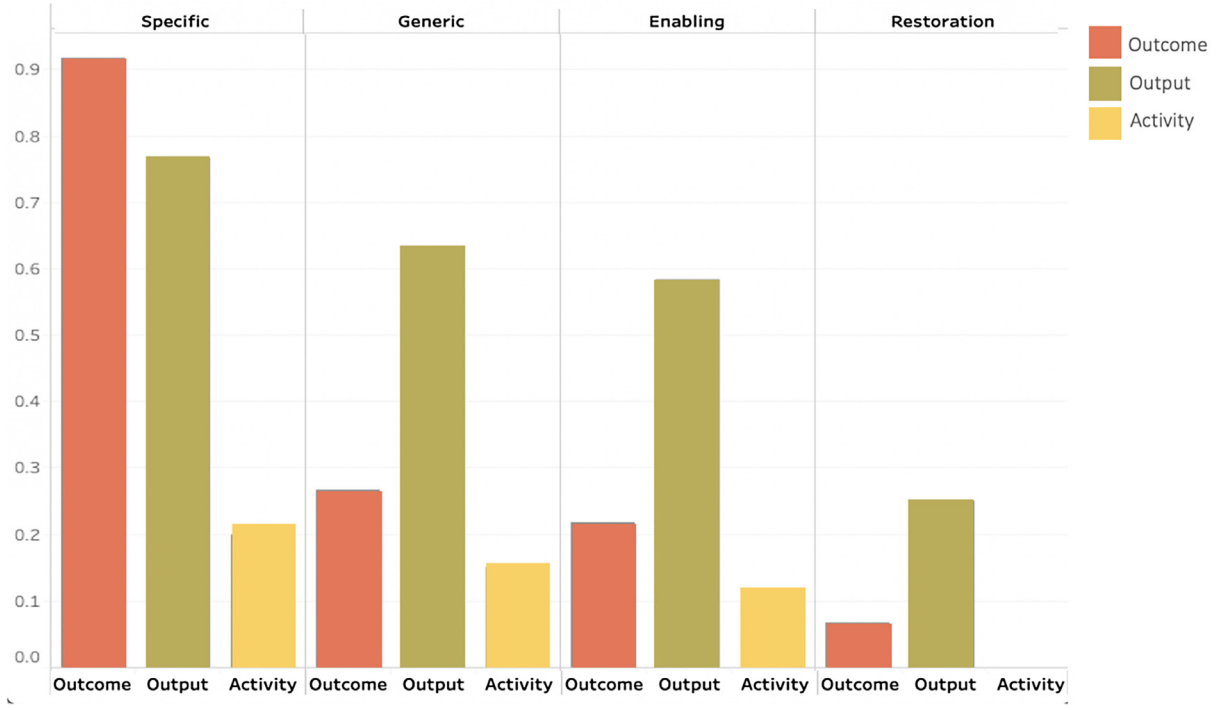

Fig. 6. The proportion of projects with outcomes, outputs, and activities contributing to each type of adaptive capacity: Specific, Generic, Enabling and Restoration. Specific adaptive capacity was the most common.

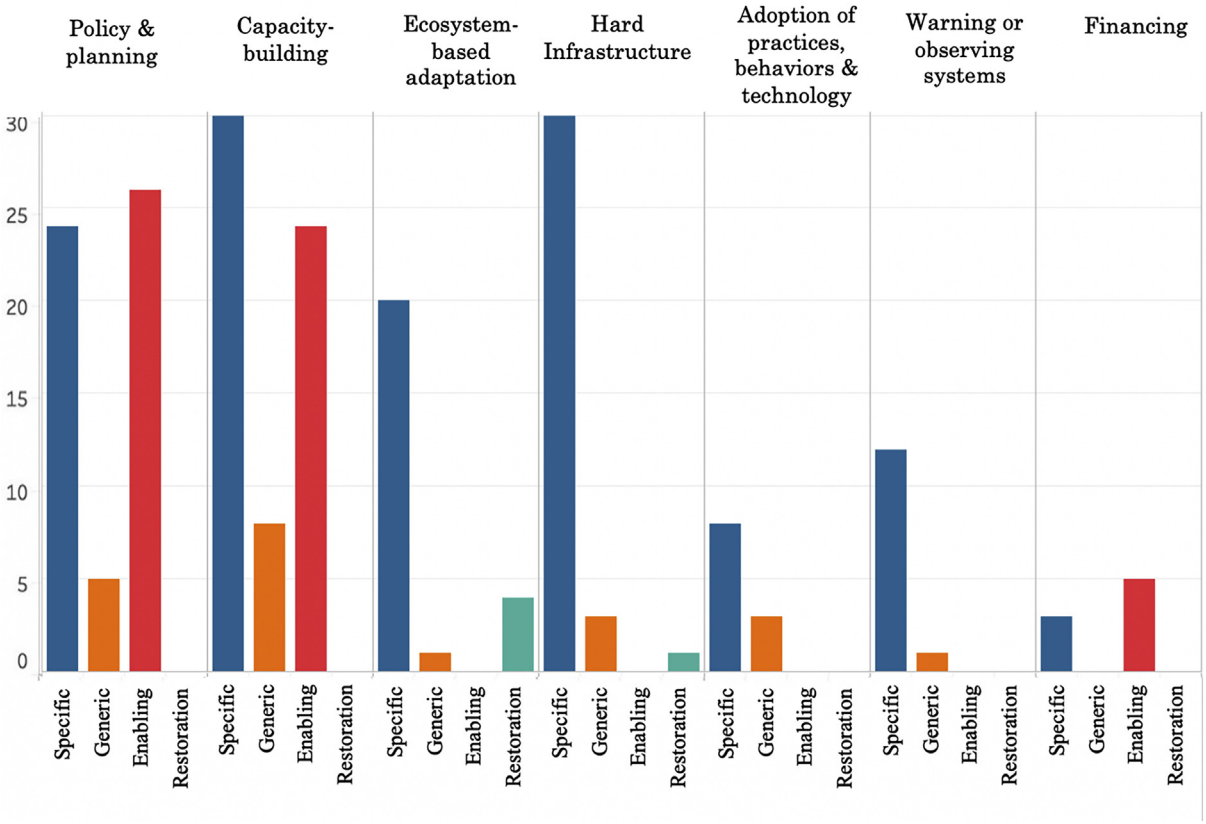

Fig. 7. The number of projects contributing to each type of adaptive capacity compared for each adaptation approach. Outcomes using ecosystem-based adaptation, infrastructure and warning or observing system approaches contributed primarily to specific adaptive capacity. The highest contributors to generic capacity were capacity-building and policy and planning, but these also were the strongest contributors to enabling capacity.

planning and capacity-building approaches compared to earlier projects and these were the primary approaches building adaptive capacity, it is likely that more recent projects were even more heavily skewed towards building specific capacity than the overall portfolio suggests. Understanding which approaches to adaptation are most likely to contribute to specific or generic adaptive capacity is useful so that decision-makers can select the appropriate strategies based on their overall goals for the adaptation project, and whether they intend to address a specific climate impact or are hoping to reduce broader vulnerabilities.

5. Conclusions

This study represents the first analysis of coastal adaptation approaches across a portfolio of multilateral adaptation funds and provides important insights into the types of adaptation approaches being invested in and the contributions of these projects to building adaptive capacity in the coastal sector in developing countries. Understanding current and past investments can help project designers, policymakers and funders make more informed decisions about the types of adaptation to focus on in the future, and the implications of current investment patterns on our knowledge of adaptation and adaptive capacity in coastal developing countries.

Coastal projects in the UNFCCC-funded adaptation portfolio were designed to incorporate a wide range of approaches, often demonstrating a sophisticated understanding of the ways that these approaches built on each other. We found that enabling activities such as policy and planning and capacity building dominated project approaches. Over time we observed an increase in the diversity of approaches included in projects, suggesting an increasingly complex and mature portfolio, but imbalances still existed. Without a more balanced investment in the full range of adaptation approaches, the UNFCCC financial mechanisms may not be maximizing their potential role of demonstrating new and innovative adaptation strategies. It is also important to consider how the UNFCCC financial mechanisms contribute to the broader adaptation finance landscape. If other funding sources are focused on certain approaches, as UNEP found for the development banks in terms of investments in infrastructure (UNEP, 2018), it may make sense for the UNFCCC financial mechanisms to focus on other approaches to ensure a balance across the investment landscape.

As the most common approach, policy and planning clearly served a foundational role in the portfolio. This was also the approach that offered the most promise for making connections between climate adaptation and other related domains, including disaster risk reduction and potentially conservation, as evidenced by the important role of ecosystem-based adaptation in the portfolio. Given the holistic, integrated thinking present in many project proposals, this portfolio offers a unique platform for experimenting with ways to bridge across these domains.

We also found that projects were designed to contribute to adaptive capacity in various ways. Across all approaches, projects were more strongly focused on building specific adaptive capacity, and there was relatively little investment in building generic capacity. Because of the importance of both generic and specific capacity for sustainable adaptation, but the imbalance in the portfolio towards more specific capacity building, adaptation activities contributing to generic adaptive capacity may not be adequately funded. Given the many potential synergies between strategies that build generic adaptive capacity and other development

objectives, this gap likely represents a lost opportunity for realizing multiple co-benefits for resilience from the multilateral adaptation funds. While it was not possible to identify the reasons for these design choices in the project proposals, funding incentives likely contributed to the decision-making process regarding project design.

Based on the number of activities contributing to "enabling" adaptive capacity, as well as the large number of outcomes focusing on capacity-building, coastal adaptation efforts appear to still be in the early stages in this portfolio, and significant further investment is needed to build upon the enabling actions in UNFCCC-funded projects so far. Many of these activities will only contribute to long-term resilience to the extent that they lead to more tangible adaptation actions in the future and the momentum established by these projects will be lost without subsequent investments. As discussed throughout the paper, these findings are not surprising given that most projects in the portfolio, even the most recent projects, were the first investments from these funds that a nation had received for coastal adaptation. As articulated in many of the project proposals, serving as a demonstration project or pilot project, and seeking to catalyze further investments in adaptation were primary goals of these projects. These projects have built a foundation but continued investment is needed, both through follow-on projects from the UNFCCC funds, and also from other sources of international and domestic finance.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

This research was funded with a grant from the Global Resilience Institute at Northeastern University, Boston, MA, USA. Special thanks to Babatunde Abidoye, Jihyea Kim, and Pradeep Kurukulasuriya at UNDP.

Supplemental material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.worlddev.2019.104748.

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