How are managers responding to local and global ecological stressors? The case of Indonesian co-managed coral reefs in the Anthropocene

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ARTICLE INFO

Keywords:
Policy entrepreneurs
Policy sciences
Co-management

ABSTRACT

I use the public policy scholarship on policy entrepreneurs to analyze how decision-makers are responding to local and global human-induced ecological stressors. Using a comparative case study in several communities in Bali, Indonesia that use co-management systems for reef conservation, I present mixed methods data from semi-structured interviews and surveys collected during fieldwork. My findings contribute to the interdisciplinary literature on coral reef management which has not leveraged the policy process literature despite its capacity for insights. I deploy a framework for effective policy entrepreneurs (Cairney 2018), defined as the agents for policy change who possess knowledge, power, dedication, and luck to be able to exploit opportune moments. This framework enables finely-grained analysis on who takes part in influential decision-making, and how responses to ecological stressors are enacted. I found that policy entrepreneurs in co-management systems include sub-national and national decision-makers, non-governmental organizations, and private sector actors. They enact policy innovations to respond to localized stressors such as illegal fishing, but are increasingly responding to stressors from climate change, namely bleaching events. I show that decision-makers implement policy innovations through the telling of persuasive stories, selection of feasible options, and use heightened attention to a problem as an opportune moment to implement their desired response (adaptation). These policy innovations include creating networks to mobilize resources, educational programs, and actual mitigation projects. I refine this framework for the context of tropical biodiversity conservation to include political history and the proximity of case communities to tourism hubs, both of which influence who policy entrepreneurs are, and how they enact responses.

1. Introduction

Over the past 30 years, a rich body of interdisciplinary literature on coral reef management has shown how co-management, or management where the government shares power with local communities and other stakeholders, has both social and ecological benefits [17]. Decades of research shows that like all other governance systems, co-management is flawed, but generally it enables communities to collaboratively and sustainably manage reefs. Possible flaws include possibly empowering wealthy, localized elites without the oversight of more centralized management, or the potential for industries that cause stressors to play management roles in the absence of centralized government [8,59].

Co-management is especially important in developing countries, with limited resources, where a shift in governance largely began in the 1990s, and resource user participation became a requirement for donor-funded development projects [39]. Consensus among multinational organizations and donors has resulted in many programs that implement or enhance co-management regimes [23]. Such programs increase legal and financial pathways for coral reef-dependent communities to build institutions, collaborative processes, rule-making, effective enforcement, and other management capacities. Much of the literature on coral reef management has documented the social and ecological impacts of an increasingly participatory style of management all over the world. In the past ten years however, the focus of coral reef management literature has expanded from the initial focus on governance and conservation interventions towards assessing the dramatic impacts of climate change. A puzzle has emerged to challenge decision-makers, researchers, and the local communities bearing the burdens of increased climate stressors: how can managers respond to ecological stressors caused in large part by decisions made at higher scales of government, often by distant countries? How are local communities, with limited resources and capacity, enacting policy and management...
responses to both climate change and localized stressors? I define managers here empirically, through in depth fieldwork described subsequently, to include village and other local level decision-makers that make decision about MPA management, non-governmental organization (NGO) workers, private sector actors (such as the dive industry and tourism industry who access the reef every day), and national level decision-makers.

This study poses some initial answers to this puzzle, drawing on public policy literature, specifically its policy entrepreneurs framework, defined as the actors responsible for policy innovations. The policy entrepreneur lens allows for a more detailed depiction of managers, how they respond to human and ecological stressors, lending new insights into the co-management of coral reefs. My research contributes to the already rich literature on coral reef management by describing how policy entrepreneurs initiate policy innovations via three specific actions: producing feasible policy solutions, telling stories about solutions to increase stakeholder support, and using opportune moments to implement innovations [15]. Using a case study design, and mixed methods, I show how two Balinese MPAs, that depend on coral reefs, are meeting the challenges of stressors such as climate change directly, bearing the risks of trying new policies to respond to climate change as well as the costs of a global problem. Managers know that their interventions will not solve the climate problem. However, my findings show that policy entrepreneurs are implementing policy innovations focused on mitigation, restoration, and education are designed to enhance social and ecological outcomes.

There have been several pieces written about one of the MPAs featured in this case study in Pemuteran. Bottema and Bush focused on private sector actors and their role in management and how predominantly private sector-led MPA management occurs (2012; [52]). The authors describe the dive industry and others as de-facto managers of this MPA as independent actions of entrepreneurs and the consolidation of several institutions towards common goals. By contrast, my research focuses on policy innovations from a wider range of actors (national, local, and village government officials, NGO workers, and the private sector), rather than focusing on the specific, albeit important, focus on decision-makers.

This article proceeds as follows. First, I provide a brief overview of thirty years of interdisciplinary coral reef management literature, and discuss the changes in the last decade to focus on climate change. Second, I provide an overview of the theoretical concept of policy entrepreneurs from the public policy literature and outline how it differs from the more commonly-utilized theories of institutions that form the strong foundation for much of the coral reef management literature. Then I provide an overview of my qualitative and quantitative methods, comparative case design, the use of secondary data on coral reef ecology, and the Indonesian case study sites.

I find evidence of a critical role that policy entrepreneurs play in formulating policy innovations for complex problems in co-managed systems. I describe recent intense coral reef bleaching episodes as events that spurred policy innovations. I characterize these innovations as network building, mitigation, restoration, and educational interventions, and give examples from case sites. I draw relationships between ecological outcomes and the capacity of policy entrepreneurs to design and implement solutions. In the discussion in Section 7, I answer three specific questions of general interest for managers in tropical developing countries: who are the policy entrepreneurs, what are they doing to respond to climate change, and how are they implementing these innovations despite low resources and capacity?

2. Coral reef management

There have been over 700 interdisciplinary studies on coral reef management authored between 1990 and 2016 [25]. This study focuses on marine protected areas (MPAs) defined as the protective management of a natural area for a range of management objectives such as protecting economic resources and biodiversity. Specifically, I analyze co-managed MPAs, which are collaboratively managed MPAs where national governments legitimize local-scale communities or governments to perform management, supported by assistance and advice of international organizations, non-governmental organizations (NGOs) and other stakeholders [7,45,69,72,73]. Communities are responsible for decision-making, design management institutions, establishing rules and enforcement, building trust and capacity, learning, and adjusting management based on learning [9]. Generally, co-management has benefitted communities and ecosystems, leading to multilateral donors to place it on the international development policy agenda, but it does have pitfalls such as possibly benefiting wealthier resource users [23].

Much of the previous research on coral reef management uses theories of institutions which allow investigators to analyze biophysical conditions, community attributes, rules, political and economic contexts, interactions between actors and institutions, and outcomes to evaluate the effectiveness of institutions for reef conservation [4,16,19,44,58,59,74,75]. These studies also highlight the potential pitfalls of collaborative management noting that although national governments can facilitate co-managed MPAs by legitimizing local autonomy, hosting meetings, and sharing information, it can work against these interests by defending industries that cause stressors (i.e. commercial fishing or developers) [59,76]. The adaptive governance lens, defined as understanding environmental change, using that understanding to make decisions, and acting on decisions to sustain resilience, has also been applied to the coral reef management context [34,57]. Key summaries of

<table>
<thead>
<tr>
<th>Citation</th>
<th>Findings summarized</th>
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<tbody>
<tr>
<td>[50]</td>
<td>Ecological indicators like biomass are related to customary management and co-management, which suggests that generally, these localized management arrangements have desirable ecological outcomes.</td>
</tr>
<tr>
<td>[66]</td>
<td>Community participation must have a well articulated process as well as the support of government, donors, and NGOs</td>
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<td>[21,23,24,77,22]</td>
<td>Coral reef management systems must include customary practices, opportunities for learning and experimentation, and have flexibility in implementation</td>
</tr>
<tr>
<td>[78]</td>
<td>Inputs such as governance, management, and local development predict social and ecological outcomes of MPAs</td>
</tr>
<tr>
<td>[79]</td>
<td>Conflict resolution mechanisms, trust, and social relationships are related to ecological benefits</td>
</tr>
<tr>
<td>[2]</td>
<td>In collaboratively managed MPAs, leadership at the community level, a community’s degree of dependence on resources, presence of a diverse combination of skill sets, commitment, and NGO involvement are critical factors to forming a collaboratively managed MPA</td>
</tr>
<tr>
<td>[38]</td>
<td>Communities have bonds to reefs that transcend material considerations</td>
</tr>
<tr>
<td>[32]</td>
<td>Co-managed reefs provide greater adaptive capacity, potential for integrated management, and legitimacy regarding responses to localized stressors such as overfishing</td>
</tr>
<tr>
<td>[48]</td>
<td>National governmental support can increase MPA effectiveness compared to situations where communities are left to self-organization</td>
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interdisciplinary papers on coral reef management are listed in the Table 1 below:

Recently, the literature on coral reef management has shifted to focus on the Anthropocene, or the new global reality under climate change [43]. Coral reefs are an obvious case because of their tendency to bleach, or expel symbiotic algae under thermal stress, turning white and making their climate impacts visible. Coral reefs have experienced three intense, tropics-wide coral bleaching episodes in the past 30 yr (1997, 2010, and 2015), caused by global warming of approximately 1 °C above pre-industrial temperatures [42,43]. The El Nino-related coral bleaching episodes of 2010 and 2015–2016 [68], resulted in many Indonesian reefs experiencing approximately 85% mortality [1].

Anthropocene studies show that reefs in the future will be unlike anything previously seen by humans [5] and that returning reefs to past configurations through local management (i.e. MPAs) will not be possible [43]. Local stressors such as overfishing and unsustainable levels of coastal development are being overshadowed by the impacts of climate change on reefs [14,28,29]. This means that local management efforts will not be enough to stave off the impacts of climate change compared to rapid, concerted, global decarbonization. However, policy responses are occurring.

Several researchers have authored comprehensive analyses of ongoing policy responses to climate impacts that include wide ranges of possible actions. Four types of policy responses that they classified include 1) large scale (global) action to stave off climate impacts, 2) transforming social and ecological systems, 3) building capacity for communities to respond to change, and 4) government assistance to diversity livelihoods [49]. Specific research on solutions describes, for example, technical approaches to enhance resilience such as assisted evolution, facilitating adaptive governance, and prioritizing the conservation of refuges or areas less vulnerable to climate impacts [51]. Wegner et al.’s comprehensive review of solutions includes climate-smart conservation of refuges, ensuring networks of connectivity of MPAs, ensuring non-climate stressors are minimized, among many others (2019).

Thus, several papers have already categorized and surveyed what can be done in the face of climate change, but fewer have focused on how managers are actually implementing policy responses. This study builds upon the rich body of literature on institutions and governance, using the policy process literature instead to analyze policy-makers themselves, and how they respond to change. The policy process literature places decision-makers and managers at the center of analysis, theorizing them as policy entrepreneurs [15,47].

3. Theoretical framework

I use the theoretical framework of policy entrepreneurs, drawn from John Kingdon’s seminal Multiple Streams Framework (MSF) to describe how decision-makers and managers enact policy responses. Policy entrepreneurs are the agents for policy change with the knowledge, power, dedication, and luck to be able to exploit opportune moments [15,47]. The MSF depicts policy entrepreneurs as those who select, promote, and later help implement a policy solution during a brief window of opportunity where several metaphorical “streams” are joined, resulting in policy innovation. The streams include an event causing increased attention in need of a policy solution (problem stream), amenable public mood (politics stream), and the general feasibility to enact the solution (policy stream). Policy entrepreneurs unite these streams, resulting in policy innovation [47].

Policy entrepreneurs perform three functions: discover needs and suggest ways to address them; bear the reputational, financial, and emotional risks for pursuing actions with uncertain consequences; and assemble and coordinate networks of individuals and organizations to undertake change [47,56,80]. The solutions that policy entrepreneurs find must be workable, as they are the ones providing convincing evidence to defend their chosen innovation [80]. Policy entrepreneurs are willing to use their positions for leverage to align problems and solutions and increase likelihood for policy change [55]. Criticisms of the policy entrepreneur framework suggest that it attributes too much agency to individuals and not enough detail on the contextual factors such as the intricacies of the political system [81]. Because so many previous studies on coral reef management address contextual factors such as governance and institutions, this study is filling gaps in the role of prominent individuals.

Policy entrepreneurs are the most appropriate framework for this research because they do not push for marginal change, but rather they seek to radically change current ways of doing things [56]. This change, which I refer to as policy innovation, is defined as the initiation, diffusion, and evaluation of the effects that their innovations create (Mintrom and Luetjens, 2017). The dramatic and increasing impacts of climate change on coral reefs make the need for radical change and policy innovation very clear.

Paul Cairney’s addition to Kingdon’s original policy entrepreneur framework is a novel three part framework of what makes an effective policy entrepreneur, providing an intuitive, normative analytic device (2018). Cairney argues that effective policy entrepreneurs tell simple and persuasive stories about their preferred policy innovations, present feasible options offered during a brief window of opportunity, and adapt to find a policy solution during heightened attention to a problem (2018).

The scholarship on policy entrepreneurs in the natural resources has described how they shape radical policy changes in water governance through coalition building, strategic framing of issues, and manipulating the decision-making forum [53,54]. Policy entrepreneurs have been shown to play major roles in forming co-managed systems for fisheries governance [3]; in drought contexts [11]; in large scale, regional institutions for natural resource management [40]; in regional emissions trading schemes [12]; and in policy networks concerned with hydraulic fracturing [41]. The effectiveness of policy entrepreneurs can be predicted by their vision, capacity to act, and the commitment of key actors to seizing opportunities [27].

Recently, literature on policy entrepreneurship has shifted to study how policy entrepreneurs are on the cutting edge of adopting climate change policy in a variety of contexts. These studies have found that fragmentation of city and regional governments predicts the emergence of climate change policy entrepreneurs [46]; that policy entrepreneurs play major roles in framing problems and in issues of scaling up climate policies through catalyzing large scale behavior change (Mintrom and Luetjens, 2017); and that the influencing strategies of policy entrepreneurs can include the use of narratives, rapport building, and leveraging networks to mainstream climate considerations into national policy [62]; among others.

4. Case selection and data

My findings on how policy entrepreneurs are innovating to respond to climate change, especially in the case of co-managed Indonesian MPAs, address an interesting puzzle: how managers in developing countries, characterized by limited capacity and resources, are implementing policy responses to climate change [82,83,84]. Although there is no intervention local communities can make to stop the impacts of climate change directly, they are nonetheless forced to adapt.

The logic behind case study site selection is as follows. I selected two co-managed MPAs, which according to Indonesian law, have management authority held by local level policy-makers. Specifically, Chapter IV Article 7 of National Law Number 27 on the Management of the Coastal Zone and Small Islands states that within 12 nautical miles from

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2 In descending order, these include provinces, regencies, cities and villages.

3 Undang-Undang Republik Indonesia Nomor 27 Tahun 2007 Tentang Pengelolaan Wilayah Pesir dan Pulau-Pulau Kecil
the shore, local government holds management power. This law lists major stakeholders including fishermen, private sector companies working in tourism, and coastal communities. I adopted this statutory definition for the targeted sampling of respondents.

The two MPAs where I performed fieldwork are located just offshore from the Northern Balinese communities of Lovina and Pemuteran, in the regency of Buleleng, approximately 40 kilometers apart, with a population of approximately 600,000 people and an economy built on ecotourism [63]. I selected Lovina and Pemuteran because of their geographic proximity to reefs (within sight of the shore), shared cultural similarities, similar historical trajectories in establishing their MPAs in the mid 1990s and transitioning economically from fishing to tourism-based economies, and similar per capita incomes. Both MPAs have similar formulations of co-management, where fisher cooperatives, private sector actors, and regency- and village-level governments have authority over MPA management. Fig. 1 below is a map of my two case sites.

I considered both social and ecological data when selecting the MPAs of Lovina and Pemuteran, namely that the ecological state of the reef should be somewhat comparable. There are many ways to assess the ecological state of a coral reef ecosystem, but due to costs and constraints, I considered a coarsely grained assessment of living coral cover, known as percent cover. Gomez and Yap’s criteria for percent cover categorizes poor (0–24.9%), medium (25–49.9%), good (50–74.9%), and excellent (75–100%) reefs in terms of their percent cover. Using secondary governmental and United Nations Environment Programme data on percentages of living coral cover in both MPAs, I used Gomez and Yap’s range and determined that Lovina has reefs categorized as poor (7.17–20.44% cover) and Pemuteran has reefs categorized as medium (23.52–38.44% cover) [64]. The sample size of two case sites is too small to say with certainty that management strategies cause ecological outcomes, but considering the cases in a comparative analysis without ecological data would be an incomplete study.

I used the process for multiple case design described by [70], where I 1) developed theory to analyze a situation (i.e. policy entrepreneurs); 2) selected a phenomenon (i.e. co-managed MPAs); and 3) analyzed data using qualitative and quantitative methods. I used Paul Cairney’s three part framework for effective policy entrepreneurs to develop my semi-structured interview questions (2018). This framework states that policy entrepreneurs tell simple and persuasive stories about their preferred policy innovations, present feasible options offered during a brief window of opportunity, and adapt to find a policy solution during heightened attention to a problem. I refined his framework in the context of coral reef bleaching to include the concept of policy innovation, or a radical change, that policy entrepreneurs initiate, diffuse, and evaluate (Mintrom and Luetjens, 2017).

Using this framework, I assembled interview transcripts with excerpts from a longer interview protocol (containing a total of 22 questions) contained in Appendix A. I then coded responses in a way that would allow me to find examples of the framework in Table 2 and to find answers to three guiding questions that will be answered in subsequent sections including who are policy entrepreneurs, what are they doing, and how are they doing it? The concepts, interview questions, and coding protocols for interview transcripts are presented in Appendix B.

I conducted a total of 81 interviews or approximately 40 per case site. Interviews focused on three stakeholder groups defined by Indonesian law as stakeholders and because my qualitative empirical work showed them to be decision-maker roles within the MPA: decision-makers (evenly divided between national and subnational level), civil society actors (such as NGO workers), and private sector actors (typically from the tourism and development sectors). Table 3 breaks down respondent numbers. I sampled respondents using a snowball methodology, where I asked key informants, beginning with local (villages-level) decision-makers, to recommend other stakeholders to interview with management responsibilities for the MPA. I would ask for a recommendation for a particular type of respondent (i.e. NGO worker) to ensure my sample was targeted to include all relevant stakeholders. These differences are, admittedly, different perceptions held by respondents. I validated the content of interviewees in an iterative fashion to ensure that if strong opinions or surprising pieces of information were given, several corroborators would be interviewed to ensure that the speaker was not an outlier. When this occurred, corroborators would not be acquired from that particular respondent.

Interviews ranged from forty minutes to four hours, and included four focus groups in Indonesian. Focus groups, or a structured group discussion, used the same questions in the interview manual. Focus groups arose informally, but were included into the project because they fit well with local customs and norms. The interview manual included 22 questions including follow up questions, but only the questions within the scope of this paper are discussed here (see Dunning [32] for supplemental analysis grounded in theories of legitimacy, adaptive capacity and trust within institutions). Interviews were performed in 40% Indonesian and 60% in English. Interviews were transcribed while they occurred. Anonymity of respondents was guaranteed, and informed consent was verbal and obtained through the use of an informational letter read aloud to respondents in English or Indonesian.

I used thematic coding to analyze interview transcriptions [35], with the policy entrepreneur framework in Table 2 as codes. Coding steps included those of the deductive content analysis protocols described by Elo and Kyngäs [33]. First, I selected the situation to analyze with the help of the theoretical framework, desk research, and field research. Then I developed a structured analysis matrix using theory and coded data according to theory.

In addition to interviews, I also collected quantitative survey data, administering a shorter, 12-question survey instrument. Surveys and interviews were taken from discrete respondents. Data from survey methods allowed me to gain a better understanding of general trends among policy entrepreneurs across cases, with the interview data explaining the rationale of decision-maker actors in their own words. Survey questions included the 4 questions listed in Appendix C. The survey was administered to 53 respondents in Pemuteran and 54 respondents in Lovina. Surveys were administered face to face, and I read the questions to the respondents because literacy is not universal among target respondents. Surveys were conducted 80% in English and 20% in Indonesian. Stakeholders were surveyed at random in areas where target respondents tended to congregate, such as local waterfronts, MPA offices, cafes, religious centers, and tourism businesses. When there was a

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4 Lovina is the name given to a collection of several villages including Anturan, Banyualit, Kaliasem, Kalibukbuk, Pemaron, Tukad Mangga, and Temukus

5 As of 2009, per capita income was 12 million Indonesian Rupiah (IDR), or $1200 U.S. dollars (USD).

6 I conducted 36 interviews in Pemuteran, Indonesia and 37 in Lovina, Indonesia in May through August of 2013 and in June and July of 2015. I supplemented the original interviews with 10 additional interviews with national level officials, private sector actors, and NGO workers in January of 2018. 83 interviews were collected in total, 2 were not used because they did not contain relevant data to the project.

7 A translator was occasionally used on an informal basis in Indonesia, where a nearby person or participant would help with translation. The author used their Indonesian language skills for the majority of interviews that took place in Indonesian.
large group of respondents who were known to have a manager role in the MPA, I surveyed every 5th person present to get as close to a random sample as possible in small villages. Surveys took place in summer of 2013, 2014, and 2015. The four questions that inform this research are listed below with justifications in Table 4, and the full instrument in Appendix B.

I recorded the survey data directly onto a cached Google Sheets spreadsheet (using both paper and digital versions) at the point of interview, with respondents anonymous, and consent obtained verbally. Analysis of case sites took place in Google Sheets and included descriptive calculations of proportions.
5. Quantitative findings

Beginning with the quantitative surveys (results presented in Table 5), using the Cairney [15] framework for effective policy entrepreneurs, I found majorities of policy entrepreneurs in Pemuteran (91%) and Lovina (53%) believe that if they have new ideas for policy innovations for management, they can share those ideas with other managers. Majorities in Pemuteran (91%) and Lovina (57%) believe that they need to tell a story about proposed interventions (persuasive stories), and convince their fellow managers to buy into stories. Majorities in Pemuteran (89%) and Lovina (75%) believe that MPA managers wait for opportune times to propose feasible policies. However, a majority in Pemuteran (91%) believed that MPA managers see stressors as an opportunity to exploit to improve management, while only 23% of policy entrepreneurs in Lovina believed the same. These findings are summarized more briefly in Table 6.

Using the lens of Cairney [15] for effective policy entrepreneurs, I can conclude that effective policy entrepreneurs are present in both case study sites. Majorities of policy entrepreneurs in both cases perceive an ability to enact policy innovations in their management system, use persuasive stories to spread their policy innovation, and enact feasible solutions. However, only in Pemuteran do policy entrepreneurs have the capacity to adapt in their reef management system. This suggests that Balinese policy entrepreneurs, in the decentralized management system for coral reefs in Indonesia, are generally effective, but with some heterogeneity among them regarding adaptability.

Why did policy entrepreneurs in Lovina not have the capacity to adapt, specifically the capacity to respond to stressors to improve management? Answers coalesced on a lack of resources and technical knowledge. Many respondents cited recurring natural and manmade stressors, such as illegal fishing within the MPA, tropical storms which result in coral breakage, or coral bleaching and mortality from climate change. Respondents said that as these stressors intensify, especially the

<table>
<thead>
<tr>
<th>Table 4</th>
<th>Quantitative differences between case communities.</th>
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<tbody>
<tr>
<td>Characteristics (drawn from [15] effective policy entrepreneurs framework)</td>
<td>Pemuteran-MPA with medium level of coral cover (n = 54)</td>
</tr>
<tr>
<td>Policy innovations: MPA managers believe that if they have new ideas for management, they can share those ideas in regular meetings.</td>
<td>0.91 Yes</td>
</tr>
<tr>
<td>Persuasive stories: MPA managers believe that they need to tell a story about proposed interventions, and convince their fellow managers to buy into stories.</td>
<td>0.91 Yes</td>
</tr>
<tr>
<td>Feasible policy solutions: MPA managers wait for opportune times to propose feasible interventions.</td>
<td>0.89 Yes</td>
</tr>
<tr>
<td>Adaptability: MPA managers see stressors as an opportunity to exploit to improve management.</td>
<td>0.91 Yes</td>
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5.1. Qualitative findings

5.1.1. Policy entrepreneurs

Who are policy-entrepreneurs in decentralized MPAs? In these two case sites, policy entrepreneurs are primarily local government officials (regency, provincial, and village decision-makers), NGO workers, private sector actors (from commercial fishing and tourism and hospitality sectors), and national decision-makers. Local government officials were responsible for making sure that policy innovations complied with national level Indonesian laws, which grant a large degree of local scale autonomy. Local government officials also collected taxes to ensure registration and compliance with conservation projects implemented in MPAs (what several private sector actors disparaged as “bribes”).

Examples include coral nursery projects or underwater sculpture gardens. Private sector actors and NGO workers were the major actors who initiated policy innovations through technical knowledge and financing. National decision-makers were responsible for ensuring that international treaties such as the Convention on Biological Diversity and the targets within them for MPAs were met. This meant that they authorized the citing of MPAs within the provinces, collaborating with NGOs and local governmental actors to do so.

Effective policy entrepreneurs were most active at the subnational (regency, provincial) and local (village) level due to Indonesian political decentralization. Decentralization is a major part of Indonesian political history, beginning with the passing of two important laws legitimizing decentralized management of biodiversity between 1999 and 2001: the Regional Autonomy Law and the Fiscal Balance Laws (Bell, 2003). These ones linked to climate change, there are few resources to try something new for management. Possible responses, according to respondents, could include a restoration or artificial reef program, which many suggested that they would like to try in the future, citing Pemuteran’s example. Respondents suggested that adaptation like I described in my questions would require more financial resources, and more people with a scientific or technical skill set that were not present in Lovina. In the words of an MPA leader:

Usually, we are focused on lost money from [tourists] less interested in snorkeling on broken reefs or white, sick-looking reefs, and less focused on a big investment in a new management idea.

Another respondent suggested adaptation is occurring but slower than how I framed it in this question. This respondent said:

We are adapting, but it is more slow and over time, not in response to an event. Things move slow here because we do not have a lot of spare cash. We will adapt to bleaching, but it will take us longer than Pemueran because we have less cash resources right now and less people who can actually build coral nurseries or similar projects.

1. K.H. Dunning


3. Quantitative differences between case communities.

4. Timeline of case study MPAs adjacent to major bleaching events.

5. Table 5

6. Table 6

7. Table 7

8. Timeline of tropics bleaching events
laws delegated power and resources to subnational governments including, in descending order, provinces, regencies, cities, and villages (Bell, 2003). In the two case sites, the primary policy entrepreneurs were at the village level.

Private sector and NGO policy entrepreneurs were the two main groups who were enacting policy innovations, supported by governmental actors, which is covered in more detail in 5.1.2. The main types of policy innovations included the formation of networks to finance, implement, and ensure the long term persistence of these innovations; bearing financial risk for new projects; generating ideas for new policy innovations; and forming educational programs to educate local people and tourists alike on ongoing conservation and stressors. Local and national decision-makers supported these efforts to varying degrees, with local decision-makers engaged throughout, and national decision-makers less so.

5.1.1.1. Pemuteran. In Pemuteran, NGO and private sector policy entrepreneurs’ most prominent role was generating new policy innovations (see 5.1.2), forming networks of conservation-oriented actors, bearing the financial risk of policy innovations, and implementing education programs. Financial risk was borne, generally, by several high profile private sectoractors, who themselves formed major networks to implement innovations. To do so, they formed NGOs to implement policy innovations such as youth programs for conservation efforts, coral restoration projects, nurseries, invasive species removal programs, and others. These policy entrepreneurs accrued wealth in hospitality and tourism or in fishing, and then used this disposable income and good standing in the community to form NGOs and fund policy innovations. Many of the policy entrepreneurs who were the major investors in policy innovations did not start their careers in conservation, but were instead, successful private sector actors who invested in conservation at the middle or later points of their careers. Although private sector policy entrepreneurs were competitive in their business affairs, they were collaborators in conservation interventions. For example, if one prominent hotel owner was installing a new artificial reef structure, they would borrow equipment, staff, or boats from a nearby competitor, stating that this was common practice. After the policy entrepreneurs had established policy innovations, such as coral restoration programs, for several years, international environmental NGOs would seek to collaborate and enhance funding. These interventions were local efforts at first, and then possibly expanded from international NGOs later on.

Why did these private sector actors choose to invest in Pemuteran and not close-by Lovina or other locations? Respondents suggested that chance played a part, as in people who were born in Pemuteran wanted to return, and in their words, “give back.” Other respondents, not originally from Pemuteran, described how they and others realized that there was a lack of a tourism boom and a slower relative pace of economic growth, which attracted them to invest where they did. They cited the greater likelihood of attracting wealthy customers looking to stay longer, in a more “low key” area, versus the type of “day-tripper” tourists that are more common in Lovina. These tourists come for a quick trip, spend less money, and leave due to Lovina’s better connectivity to tourism hubs in the South of Bali. Respondents agreed that the tourism boom in Lovina in the late 1990s was due to the ease of South-North road travel on the island, compared to tourists reaching Pemuteran, which would require an additional Western leg of travel and several more hours. Others attributed the tourism boom to Lovina being featured in popular travel guides. This gave Pemuteran a slightly more “quaint” feel, attracting the types of private sector actors seeking to invest in conservation but also in more luxurious, private ventures.

5.1.1.2. Lovina. Lovina had a similar group of actors as policy entrepreneurs, consisting of a combination of village and other local level decision-makers and private sector actors, with minimal NGO presence compared to Pemuteran. The private sector actors in Lovina that held the most influence were long line tuna fishermen who had in the 1990s diversified their incomes to include coral reef tourism by building, for example, small bungalow hotels and snorkel rental stands along the beach front. Similar to Pemuteran, these private sector actors with local government counterparts (primarily village, regency, and province government) enacted policy innovations that included: formed networks to finance, implement, and ensure the long term persistence of these innovations; bearing financial risk for new projects; and forming educational programs to educate local people and tourists alike on ongoing conservation and stressors. These actors possessed fewer financial resources than their counterparts in Pemuteran who had made their wealth in tourism and hospitality.

The network that they formed to manage the MPA had sophisticated written rules, policy innovation procedures, and voting mechanisms for the governance of the MPA. These were contained in governance documents which outlined roles, responsibilities, and decision-making processes for the MPA, and enabled policy innovations to occur to respond to stressors. Stressors could be social stressors, such as an MPA manager losing their engine to mechanical problems, they could borrow cash from an MPA insurance program to replace it. Stressors could also be ecological, such as a major tropical storm resulting in severe coral breakage, where MPA managers have a step-by-step process to negotiate access to nearby reefs to bring tourists there until their reefs have recovered. More information on the specific policy innovations follows.

5.1.2. Policy innovations

Policy entrepreneurs were the sources of policy innovations, enacting them by telling stories to convince others to agree to implement ideas, by ensuring their innovations were feasible, and doing so in an adaptable manner. Respondents in both communities implemented policy innovations, first and foremost, to ensure that they could earn a living from tourism on the reefs. They described two specific causes of policy innovations. The first cause included human stressors with more localized sources such as illegal and destructive fishing, and coastal development. The second cause for innovations were more globalized stressors, namely climate-related coral bleaching. In both communities, my quantitative findings showed that policy entrepreneurs believe that they can generate new policy innovations in the face of stressors. Policy innovations to respond to both local and global stressors were observed in Pemuteran only. By contrast, in Lovina, policy entrepreneurs are responding to localized stressors exclusively, and are able to envision but not fully implement policy innovations to globalized stressors.

The shift to focus on policy innovations for global stressors is relatively recent. After the 2010s, policy entrepreneurs in both case sites described a shift in the types of policy innovations that were necessary: those to address climate change, evidenced in recurring bleaching events that were becoming more extreme. Respondents in both communities said that the need to respond to bleaching began around this time frame and is becoming a more urgent stressor than all of the more localized stressors that the MPAs were established to protect in the 1990s. Policy entrepreneurs noted that because the impacts of coral bleaching are easy to see, from both above and below the waterline, there is consensus over its status as a management priority. Respondents in both communities mentioned that in their lifetimes, the change to the frequency and intensity of bleaching episodes is obvious, and is the subject of significant local concern for the future of a tourism-focused economy. Table 6 displays a timeline of major global bleaching events with management changes in case study sites.

- Respondents agreed that many forms of illegal and destructive fishing after the 2010s tended to come from international sources such as Thailand and the Philippines; this was widely corroborated. Distinguishing between local vs. global stressors in this paper is meant to reflect where the impacts of the stressors occur. For example, illegal fishing impacts happen in localized settings, but global emissions happen far away.
Policy innovations to respond to local and global reef stressors fell into several additional categories that include: stakeholders building collaborative networks, securing financing for innovations, implementing innovations themselves such as performing mitigation and restoration (i.e. building artificial reefs), and implementing educational programs. The following subsections describe specific policy innovations in case sites.

5.1.2.1. Pemuteran. Pemuteran policy entrepreneurs built strong local networks to implement policy innovations allowing them to pool resources and fund innovations such as the construction of artificial reefs, restoration projects, underwater sculpture gardens, coral nurseries for recovered naturally broken pieces from storms, and the installation of several electronic coral growth technology systems under water. Networks of policy entrepreneurs helped secure the large amount of scientific expertise required for these types of policy innovations. Managers knew that these types of local interventions would not stop climate change, they were committed to intervening in ways that would take pressure off reefs during major bleaching episodes, attract tourist visitors, and provide diversified diving experiences in the event of coral mortality. A village decision-maker summarized their purpose succinctly, calling them, “a way to do what we can.” NGOs and private sector actors were the most effective policy entrepreneurs, according to my interview data, supported by sub-national and local government officials legitimizing and authorizing their projects under various Indonesian conservation policies and laws. Respondents described NGO and private sector actors as the main implementers of innovations in a majority of interviews, emphasizing them as a starting point for ideas, and governmental actors as a facilitator.

Beginning with networks, policy entrepreneurs in Pemuteran established a network of village notables (typically men aged 16–65) to act as decision-maker managers based on Balinese Hindu religious customs. This network wears traditional ceremonial dress, has an established office on a busy beachfront site popular among tourists, conducts patrols of the MPA, collects donations for facilities and activities, and raises awareness of the community and tourists alike about stressors. They view acting as stewards of the MPA much like a religious obligation, and imbue their day-to-day work with religious customs and rituals. This network was originally established to respond to local stressors to stave off destructive fishing, formulate rules, monitor, and conduct enforcement within the MPA. Increasingly, policy innovations that focus on climate change are the priority.

Policy innovations also included educational programs on coral bleaching for community members and tourists, collaborations with universities to study local reefs, forming and collaborating with conservation NGOs, and initiating and sustaining restoration projects on local reefs. Educational programs became draws for tourist visitors, and provide diversified diving experiences in the event of coral bleaching. A similar network of policy entrepreneurs met regularly, deliberate MPA access rules, and enact collaborative financial programs for members such as insurance programs. This network is effective at responding to local stressors, such as the need to collaboratively raise capital to install mooring points so that anchors used for tour boats would not damage reefs. Ideas for responding to more recent coral bleaching stressors was a problem for which they felt they had no solution. Frustration was palpable among policy entrepreneurs in both MPAs, but more common in Lovina, evidenced in the representative words of one respondent below:

"It is difficult to see that we have worked hard to manage the reef sustainably, and made a lot of changes, but what we are seeing with the bleaching is caused by people who don’t even live here. No matter what we do locally, it will never be enough."

Community members noted uncertainty about potential policy responses for climate stressors and even noted that certain tourist groups actually liked the esthetic of bleached coral reefs. They cited a lack of capacity and investment to assist the community in initiating responses, citing a specific need for more NGOs and private sector investments. Policy entrepreneurs were implementing educational programs for conservation, such as telling their snorkeling customers not to touch the reef while snorkeling. These programs were notably less developed and more ad-hoc compared to the ones in Pemuteran. They largely depended on individuals operating boats for snorkel and dive tours to tell customers about the rules within the MPA, such as no touching and no harvesting.

5.1.3. Persuasive stories

The framework for effective policy entrepreneurs says that compelling stories persuade others to enact policies. Majorities of survey respondents in both sites (91% Pemuteran and 57% Lovina) believe that they tell stories about proposed interventions and convince their fellow managers to buy into stories. Both case sites had policy entrepreneurs who told stories of increased tourism visitors, livelihood benefits, and conservation actions in order to earn support for their desired policy innovations.

5.1.3.1. Pemuteran. An example of policy entrepreneur stories that mobilize others to invest and support innovations emerged in response to bleaching events, which started recurring with regularity. The most popular reefs would experience moderate to severe bleaching, and policy entrepreneurs needed a way to allow visitors to continue to dive and snorkel on the reefs while simultaneously reducing some visitor pressure on reefs. Policy entrepreneurs drew on culturally important religious stories such as the Ramayana, borrowed popular figures from those sources, and created underwater sculptures depicting their images. Fig. 2 below is a land-based model for one such underwater sculpture garden for all to see containing many sacred Balinese Hindu

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9 A Hindu epic with origins in ancient India on the life of Prince Rama, it is considered a sacred text and read by millions of people every year [67].
figures. Tourists may rent snorkel and dive equipment and hire guides to bring them to visit these attractions.

Policy entrepreneurs used stories and symbols to build support for an intervention that was both popular among tourist visitors (thereby benefiting livelihoods) and helps to reduce pressure during severe bleaching events. In the words of a representative policy entrepreneur:

We had the idea for artificial reefs long before bleaching, but the repeating severe bleaching episodes started a more organized effort to find money to finance the construction and placement of the sculptures, as well as local buy in from [government] managers who authorized them being installed on the reef.

An important feature of co-managed reefs is how policy entrepreneurs from the private sector and NGOs also act as stewards. Policy entrepreneurs and their employees provided the financial and labor capacity to install underwater sculpture garden dive sites and nurseries. It is important to note that the initiation of this idea and the work to secure financial resources and knowledge was primarily a local act, with international NGOs offering funding and support several years after the first localized responses were successful. Other important factors that enabled this innovation included cash flow from tourists from Indonesia as well as international (Western and East Asian) tourists, who were asked by the network of policy entrepreneurs to donate to these community efforts.

Without the initiation, continued stewardship, and dedication from policy entrepreneurs, policy innovations would not have occurred. Respondents viewed the increased international attention, evidenced in grants from international NGOs, as a way to keep the original local projects going and expanding. Policy entrepreneurs did not view installing artificial reefs as a solution to climate change, but rather, as one mitigating factor that could offset some loss of coral and address the need for reduced pressure on reefs from visitors during major bleaching events. Several respondents echoed this point of view, “If climate change continues to worsen, these artificial reefs may be all we have left.”

### 5.1.3.2. Lovina

Policy entrepreneurs use stories to develop policy innovations for localized stressors but not global stressors. Much of this had to do with the way that management changes were made: through a majority voting process. For example, in the early 2000s, policy entrepreneurs sought to prevent overcrowding on locally operated wildlife tours (dolphin viewing) and snorkeling trips. Policy entrepreneurs who advocated for smaller numbers of tourists on locally owned boats had to convince a majority of tourism operators on the MPA to agree to this change. That could mean lower incomes and fewer customers per day. To collect enough votes to cap numbers of customers on boats, policy entrepreneurs told stories about how overcrowded boats were making local tourism seem “cheaper” and “less safe” for people. They described tours with fewer people on boats and fewer boats crowding popular wildlife viewing spots as a way to build the reputation of Lovina as an ecologically friendly tourism location. They also won votes by suggesting lowered numbers would increase exclusivity, making the site seem more luxurious. Respondents noted that once this decision was made, visitors seemed to appreciate smaller numbers present in tour boats. “Our trips are more eco-friendly and less crowded now,” one operator said during an interview while showing me a photo of a recent trip.

Storytelling about policy innovations for climate stressors was not present. This was due to the legitimate perception that political entrepreneurs could not enact policy innovations to respond to climate change. When I asked why there was a difference between Lovina and Pemuteran, respondents pointed to policy entrepreneurs themselves, naming particular hotel owners, villager leaders, and NGOs in nearby Pemuteran, arguing that they initiated the conservation programs and that similar policy entrepreneurs with that level of resources and knowledge were not active in Lovina.

### 5.1.4. Feasible policy solutions

The next concept in the effective policy entrepreneur framework includes feasible solutions that managers present to address problems. Both Pemuteran and Lovina managers presented many feasible solutions to stressors with localized causes that have been previously introduced (including networks, financing, educational programs, and restoration projects). Where there was a major difference between the two case sites was in the feasible solutions to address the impacts of climate change. It’s important to emphasize that in Pemuteran, the responses to climate change were not viewed as a solution to the problem, but rather as an intervention that lessened the social and economic impacts on livelihoods.

#### 5.1.4.1. Pemuteran

In Pemuteran, an example of a policy innovation included restoration-focused programs where managers constructed
coral nurseries to mitigate not only bleaching but also tropical storms which result in significant breakage of coral. Managers innovated to finance restoration, such as requiring an extra conservation tax to dive certain areas in the MPA (equal to approximately $2 per diver), and placing wires that spelled the name of a donor as a foundation for broken coral to grow (Fig. 3). This cost approximately $50 and acted as a cash infusion for financing monitoring and educational programs aimed at both tourists and local villagers. The formation of networks to fund and install these projects made the innovations themselves more feasible.

Educational programs were another particularly feasible policy innovation because their initial startup cost was low and they could grow incrementally through time. The focus of educational programs in Pemuteran used to be the no-take rules of the MPA, but they increasingly focused more on climate impacts. Education projects and programs included a wide range of efforts from posters along the shoreline to classes for teenagers and young adults to learn to remove invasive species from the reef. An example of an education program to respond to climate change impacts includes how several respondents from an NGO regularly meet with local dive shop staff and discuss the science behind coral bleaching and why it is important not to allow divers to kick sand onto the reef while it was already stressed from bleaching. While dive shop owners may be aware, many lower level employees that lead dives do not possess a formal education, and the MPA managers are their main source of education for coral reef science.

5.1.4.2. Lovina. Lovina policy entrepreneurs were implementing feasible policy innovations for localized stressors but had fewer resources and connections to implement similar restoration programs to those of Pemuteran for global stressors and bleaching. An MPA leader described the reason:

We are not as wealthy as Pemuteran, they have a few key players there that fund the expensive nursery projects. We stick to what we know, getting more people involved in joining the MPA and in volunteering for projects such as mooring points to prevent anchor damage. These are more feasible for us.

This quotation encapsulates two main ideas present in Lovina: the absence of wealthy private sector elites for financing capital-intensive restoration projects such as nurseries, and the linked focus on more feasible interventions. Mooring points are an example of a feasible policy innovation with an important role to play in preventing reef damage. Mooring points would get removed annually, or every two years, by tropical storms. This would lead to a moderately costly and labor intensive repair process. Several communities within Lovina managed the process for re-installing the mooring points by making a schedule of rotating responsibility to provide the cash and labor for repair. While not as obvious and widely publicized as the reef restoration efforts in Pemuteran, these efforts were critical for reducing localized stressors. Formation of a network made these projects more feasible.

5.1.5. Adaptability

The final concept contained in the effective policy entrepreneur framework includes the idea that actors are able to enact a desired change in the face of a stressor (an action called an adaptation). The El Niño related bleaching events that occurred after 2010 were moments where a majority of managers realized that bleaching and associated mortality was becoming regular. In the words of one respondent, this signaled a “mindset change, where we learned we need to live with bleaching and adapt.” Bleaching events or similar hazards like tropical storms have received attention in the scholarly literature as what are called “focusing events,” or unanticipated, rare, and harmful events that gain the attention of policymakers and other important stakeholders resulting in policy responses [10]. Scientific studies show that coral bleaching will likely become an annual or biannual event over the next three to five decades [31]. Although a majority of respondents had not read the science behind bleaching, because they witnessed its increased occurrence, they knew it was increasing in frequency and severity.

The general consensus among managers and stakeholders was that bleaching was increasing in frequency and intensity. This greatly enhanced buy-in for conservation projects and what respondents termed, “doing what we can” to innovate in response to climate change.
subject for future research.

government actors supported these activities, as they knew the impor-
sector actors and NGO workers supported by sub-national and local
innovation, and adapt.

entrepreneurs, my findings show that effective policy entrepreneurs tell
were to support Lovina MPA managers to enact these projects they could
(both human and financial) required to implement restorations or arti-

ties: some basic scientific knowledge or training, knowledge of

prominent policy entrepreneurs that played major roles in policy in-

novations in a particular place? The answer to this question

policy innovations in a co-managed

manuscript arrangements without state support. My findings, and

how did policy entrepreneurs enact their innovations? This question

5.1.5.1. Pemuteran. Policy entrepreneurs in Pemuteran knew that
artificial reefs and underwater statues reduced some pressure on
stressed reefs without addressing underlying causes. However, the
ability of political entrepreneurs to secure the large amount of resources
(both human and financial) required to implement restorations or arti-
ficial reef construction was noteworthy. Respondents attributed strong
local leadership among private sector, NGOs, and local governmental
actors for the ability to recognize the increasing threat of bleaching and
adapt accordingly through the design and implementation of these
programs, noting that many policy entrepreneurs had several key ca-
pacities: some basic scientific knowledge or training, knowledge of
fundraising campaigns, and the administrative skills required to get
necessary permissions from local rules at the village, municipal, and
provincial level.

5.1.5.2. Lovina. Those in Lovina believed correctly that so long as their
MPA continued to address longer running stressors (such as illegal
fishing or damage to coral from anchors and divers) that this has an add-
on effect of making their reefs better able to survive a bleaching episode.

Many respondents emphasized that they want to install nurseries, do
coral transplanting, or other similar projects, but they lack the key ca-
pacities, including scientific knowledge and fundraising campaign
management skills. However, administrative capacity is quite high. This
was made evident from interviews. This suggests that if NGO or private
sector actors, possibly supported by local and national government,
were to support Lovina MPA managers to enact these projects they could
succeed here as they were in Pemuteran.

6. Discussion

Utilizing the Cairney (2018) [15] framework for effective policy
entrepreneurs, my findings show that effective policy entrepreneurs tell
compelling stories about their desired innovations, advocate for feasible
solutions, use heightened attention to a problem (caused by emerging
regular bleaching events) to build consensus behind their idea for
innovation, and adapt.

In my research, the most effective policy entrepreneurs were private
sector actors and NGO workers supported by sub-national and local
government (i.e. regency, province, and village). In Pemuteran, political
entrepreneurs with considerable wealth from the tourism sector sought
to implement policy innovations within the MPA as a way to conserve
the ecosystem for livelihood purposes, to attract tourists. NGO and local
government actors supported these activities, as they knew the impor-
tance of reef stewardship to the local economy and way of life. Whether
such interventions have led to improvement in ecological function is a
subject for future research.

Analyzing Pemuteran and Lovina in a juxtaposed way brought up an
important question: why do policy entrepreneurs choose to enact their
policy innovations in a particular place? The answer to this question
may assist other localities seeking to enact innovative policy responses
to climate change. Other research on coral reef management suggests that
accidents of geography and proximity to markets have major im-

pacts on coral reef fisheries and biomass of refs [13,20]; and that macro

and local context are the major predictors of beneficial MPA outcomes
[85]. My findings support these studies’ findings, suggesting that
prominent policy entrepreneurs that played major roles in policy in-

novations sought a community far from major tourist hubs. The
macro-scale political phenomenon of decentralization in Indonesia
meant that private sector actors, NGOs, and sub-national governmental
actors had significant autonomy in generating and implementing policy
innovations.

The outsized role that wealthy elites from the private sector play in
acting as policy entrepreneurs and financing policy innovations provides
evidence for an argument often made against co-management. This
argument is that decentralizing governance of natural resources merely
replicates the dominance of wealthy elites at the local scale [6,8]. My
findings suggest a more complicated scenario, where Indonesia’s
decentralizing laws and institutions counterbalance the power accorded
to policy entrepreneurs. National level decision-makers pointed out in
interviews that Indonesian institutions, in this case, provide some buffer
against coral reef governance being off limits to all but elites. For
example, if wealthy expatriates want to establish a local company (such
as a hotel or dive shop), this company is subject to rules whereby a
limited liability company known locally as a Perseroan Terbatas, or PT,
must have majority ownership by an Indonesian. This is an example of
the extent to which national level decision-makers in ministries were
involved in management, and it is not policy innovation. Rather, they
ensured that businesses operating within the MPA comply with national
legislation and possess the proper permits. My findings suggest that
involvement by province-, regency-, and village-level governments, such
as requiring private sector actors to secure permission and pay local
taxes, offset these power dynamics that if unchecked, would effectively
mean private sector elites would be completely in control, and in other
countries like nearby Malaysia, dynamics such as these occur [52]. This
has important ties to Indonesian political history of decentralization,
and may not be replicable in places where decentralization is newer or
weaker.

Other studies analyzed private sector actors, including [86] who
showed that in Pemuteran and another Indonesian case site in Bali,
private sector actors increased conservation awareness, provided in-
come alternatives, and financial capital, but were unable to provide
institutionalized arrangements without state support. My findings,
and likewise theories of policy entrepreneurs, suggest that drawing a line
between the roles of a local government (specifically province, regency,
and village level government) and the roles of the private sector actors is
a complex process where roles are blurred. Rather, examining policy
innovations and how they occur makes more sense in a co-managed
setting where private sector actors, NGO workers, and sub-national
government officials can have equal power and capital (both social
and financial) to implement policy innovations. My findings highlight
theoretically important actions of policy entrepreneurs, through their
use of story-telling, opportune moments, feasible solutions, and adap-
tation, all of which enable policy innovations.

My main theory-relevant findings answer two questions: What did
policy entrepreneurs do and how did they do it? Policy entrepreneurs
came up with ideas to respond to local stressors (such as mooring point
construction) and global stressors (such as changing climate), and
implemented them. Ideas, or policy innovations, included forming net-
works, education programs, financing strategies, and mitigation/resto-
ration projects. Pemuteran, because its policy entrepreneurs had greater
financial and scientific capabilities, has policy innovations responding
to climate change, while Lovina does not. Quantitative findings show
that majorities in both communities believe they are able to generate
new ideas for policy innovations, to tell stories to encourage others to
adopt their ideas, and to offer feasible policy innovations. Pemuteran
respondents viewed ability to adapt as being more feasible than those in
Lovina.

How did policy entrepreneurs enact their innovations? This question
is where the importance of the comparative design of the project be-
comes obvious. Policy entrepreneurs were responding to the daunting
challenge of climate by leveraging the social and economic power they
had amassed through their role primarily in the private sector and in
NGOs. They used culturally relevant stories, primarily Balinese Hindu
religious ones, to design interventions on the reef that were popular
among visitors, but took visitor pressure off stressed coral reefs. For
example, the artificial reefs with religious figures from the Ramayana
attracted visitors who were willing to pay extra into a conservation fund,
while allowing bleached stressed coral to recover. These innovations
were popular among visitors and locals, and drew visitors off of reefs,
allowing trip numbers to be split between artificial and natural dive
sites. The popularity of these sites attracted further financial support
from international NGOs, allowing managers to expand the project, and introduce educational programs as well. The bleaching was viewed as a focusing event, or a window of opportunity, to demonstrate the need for projects such as coral restoration projects. Fig. 4 summarizes who policy entrepreneurs are, what they do, and how they do it.

6.1. Revised theoretical framework

I propose several additional components of the framework of effective policy entrepreneurs in light of my case data. First, the role of a country’s political history (in Indonesia, decentralization plays a major role), and second, spatial proximity to major tourist hubs influence the effectiveness of policy entrepreneurs. These features explain why certain actors become policy entrepreneurs, and why some effective policy entrepreneurs act in some localities and not others. These variables are included in Fig. 5. Political history (specifically that of decentralization) will determine which policy entrepreneurs are effective and active to begin with. In Indonesia, national-level decision-makers had a very limited role in management of the MPAs, compared to a nearby place with similar natural resources like Malaysia, with significant management responsibility for those actors [32]. Distance from major tourist hubs was one of the main reasons respondents provided when asked why policy entrepreneurs chose Pemuteran to implement conservation projects and form NGOs. In this revised framework, I also chose to distinguish between localized and global stressors, since policy entrepreneurs may be effective at responding to one suite of stressors, much in the same way that policy entrepreneurs in Lovina were able to respond to local stressors but not to climate stressors.

There are several studies on coral reef management with findings relevant to my own. Berkes [8] discusses policy innovations and the new ideas that inspire such innovations as “knowledge generation”, arguing that bridging organizations, which provide an arena for knowledge production and trust building, generate ideas for new policy innovations blending science and policy. My research contributes to the notion of a bridging organization, in my case the private sector actors and NGOs working on conservation, and adds a finer resolution to the individuals that make up these organizations. Several studies have described a wide range of policy innovations that MPA managers can use to respond to climate change in the coral reef context (i.e. [43], [65], McCleod et al., 2019). Mitigation and restoration strategies are discussed in these papers, as are general governance recommendations such as the need for institutions to be flexible and adaptable. My research suggests that policy entrepreneurs, and their perceived capacity to generate and implement new ideas may contain an even larger range of ideas, such as that discussed in studies such as [43].

A seminal study by Cinner et al. described the criteria of a “bright spot” whereby an MPA was effectively managed despite stressors. According to Cinner, bright spots require site specific research, like that presented here, with a finer resolution on people and their actions (2016, pg. 418). Pemuteran meets several bright spot criteria including its high level of local engagement, customary tenure, and flexible governance that fosters learning. It may be in the comparative case site where we may draw the most important lessons on roadblocks to implementing policy responses to climate change.

These roadblocks were caused not by managers knowing too little about climate change, but rather by their nuanced understanding that climate was a global phenomenon with minimal power to be staved off by their actions at local scales. What one respondent called “bleaching hopelessness” is a term that can be used to characterize the lack of policy innovations in the second case site. Admittedly, policy entrepreneurs, their ideas, connections, and financial support were less effective in Lovina, but a lack of ideas among managers on how to respond locally when the cause was global was pointed to repeatedly; grounded in the very real situation where their actions would only improve human and natural systems on the margins. These actors were behaving rationally in a world without global action aimed at reducing greenhouse gasses.

7. Conclusion

This case study demonstrates the important role that policy entrepreneurs play in conserving coral reefs, and sheds greater light onto how they engage in conservation in co-managed systems. This is important because since the 1990s, global donors and NGOs are investing in building capacity in communities for co-management as an alternative to centralized management [23]. My contribution to the rich interdisciplinary literature on coral reef management is that, in concert with

<table>
<thead>
<tr>
<th>Who are Policy entrepreneurs?</th>
<th>What do they do?</th>
<th>How do they do it?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Village and other local level decision-makers</td>
<td>Collect taxes on local private sector actors, grant approval for local projects and activities, coordinate with higher level officials (regency), ensure compliance with national laws.</td>
<td>Building networks, local enforcement mechanisms</td>
</tr>
<tr>
<td>Non-governmental organization (NGO) workers</td>
<td>Formulate policy ideas for responding to local and global stressors, raise funds, bridge between international and local policy entrepreneurs, provide capacity to implement responses.</td>
<td>Building networks, restoration projects, educational programs</td>
</tr>
<tr>
<td>Private sector actors (i.e. dive industry, marine industry, travel and tourism industry)</td>
<td>Formulate policy ideas for responding to local and global stressors, raise funds, bridge between international and local policy entrepreneurs, provide capacity to implement responses.</td>
<td>Building networks, restoration projects, educational programs, bearing financial and reputational risks</td>
</tr>
<tr>
<td>National Decision-makers</td>
<td>Sign treaties, administer treaties, make sure local decision-makers comply with Indonesian law.</td>
<td>Building networks, international enforcement</td>
</tr>
</tbody>
</table>

Fig. 4. Policy entrepreneurs, what they do and how they do it.
institutions and adaptive governance scholarship, public policy scholarship has the potential to reveal details on how individuals initiate ideas for policy innovations, leverage external events to implement them, build networks to finance and secure buy-in for innovations, and ensure that their policy innovations persist over time by building connections to the private sector and NGOs.

My findings show that there are differences between the scales of stressors (local vs. global) for which policy entrepreneurs can initiate ideas, use stories to convince others of the usefulness of their policy innovations, design feasible solutions, and adapt. The differences in the two case sites suggest that policy entrepreneurs have less power to adapt via policy innovations in some places versus others. The differences may be explained by obvious factors like a lack of financing and scientific capacity, but also by surprising factors such as the proximity to major tourist centers and political decentralization.

My qualitative findings have several takeaways. First is that both co-managed MPAs saw two types of policy innovations. First included responses to local stressors, such as implementing rules and enforcement to stop illegal fishing in the 1990s to 2010. Then, after 2010, policy entrepreneurs began to see climate change as the most prominent stressor. Some policy entrepreneurs implemented policy responses such as restoration programs, mitigation projects, and education and outreach programs through their established networks. Policy entrepreneurs knew that these would not prevent bleaching, but wanted to respond nonetheless. Future scientific research on the role of artificial reefs and nurseries can determine whether the dive trips made to those sites provide significantly less stress on reefs. By contrast, policy entrepreneurs in the comparison site expressed a widely held desire to implement policy innovations, but did not know what they could do, because the stressor was caused by actions at the international scale.

In co-managed systems, NGOs and private sector actors were the major sources of policy innovations for responding to climate change. The most effective policy entrepreneurs, who initiated and secured financing and buy-in for these projects, were well known throughout the case sites, and their presence and dedication to implementing these policy responses were considered the main reasons for the existence of those projects and programs, as well as the willingness of policy entrepreneurs to put their own money into the projects. A lack of policy entrepreneurs implementing innovative responses can be explained by a lack of resources, by random chance (such as somebody deciding to move to a location), and historical patterns in laws and development. That said, knowing that policy entrepreneurs make personal choices to settle and invest, which increases capacity to enact policy innovations, local leaders can make efforts to attract them. Most respondents said that places with little corruption were more attractive to them, along with other factors like the natural environment.

Broader lessons from this research for biodiversity conservation in developing countries include that co-managed, or “bottom-up” management systems, have NGO workers and private sector actors in the roles of effective policy entrepreneurs. Policy scholarship helps us to analyze what that role in conservation actually looks like. Focusing events, like increased bleaching events, have caused a shift in policy innovations to focus more on climate stressors. Forming networks, mitigation, restoration, and educational programs are the feasible innovation types, with an important counter argument: while these innovations are important, they are occurring at the margins. One thing is clear: without global climate action to reduce emissions, no amount of local policy innovation will be effective. The very concept of a policy entrepreneur, as an individual, places too much focus on change making at the individual level, and not enough emphasis on the systems change required for meaningful climate action.

Author statement

There is no conflict of interest in this manuscript. Kelly Dunning is the sole author.
Acknowledgements

Thank you to Amanda Alva, Sabine Bailey, Dr. Katie Corvey, Thomas Moorman, and Kasen Wally for reading this manuscript; to the U.S. Fulbright Program, specifically the Malaysian-American Commission for Educational Exchange (MACEE) for funding the fieldwork; and to Dr. Larry Susskind and Dr. Porter Hoagland for initial ideas for the manuscript.

Appendix A. Interview questions for this study bolded text

*These interview questions were often followed up with a request for an example.*

1. What level of government manages MPAs?
2. What households are allowed to engage in reef based tourism, including snorkel and dive tours, operating boats, owning shops etc.?
3. Who can make rules/management ideas/policies for how reef tourism workers access and use the reefs? Follow up: How do MPA managers convince their fellow managers to buy into their ideas? Can you provide an example of a time you did this?
4. Can reef tourism stakeholders make new policies for reef management? Can you provide an example of a time you did this?
5. Who monitors the reef to make sure poaching and illegal fishing do not occur?
6. Are there punishments for violators? (follow up: are there different levels of punishment for someone using dynamite versus someone using a spear gun?)
7. Is there a way for reef tourism stakeholders to resolve conflicts and disagreements?
8. Can all stakeholders participate in management decisions?
9. If locals cannot solve a problem, can they involve higher levels of government?
10. Do you see environmental conservation and your livelihood as being linked?
11. Do reef tourism businesses invest in projects that help conservation?
12. Does the reef management organization respond to crises (such as illegal fishing) in a way that helps you continue to earn a living based on reef tourism?
13. Do NGOs assist MPA managers or business owners in management?
14. Does the reef management organization actually protect the reef?
15. Is the reef management institution something that you value and respect or does it not work?
16. Are there official power-sharing arrangements that give responsibility to the village?
17. **How does the reef management organization respond to crises (something bad happening on the reef)?** Can you provide an example of a time you did this?
18. The reef management institution sees that one of its programs is not working (For example, it learns that large amounts of poaching happen during a certain time of year) Can it change its program to address this problem?
19. **Does the reef management institution support stakeholders who want to intervene for conservation in innovative or creative ways?**
20. Is the reef healthier today than in the past? Why or why not?
21. What are some good things that stakeholders do for conservation?
22. What are the challenges that locals face for conservation?

Appendix B. Concepts, interview questions, and coding protocols for interview transcripts

<table>
<thead>
<tr>
<th>Concept</th>
<th>Question asked to respondent</th>
<th>Possible coding responses for this concept</th>
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<tbody>
<tr>
<td>Policy Entrepreneurs: An actor that discovers needs and suggests ways to address them; bears the reputational, financial, and emotional risks for pursuing actions with uncertain consequences; and assembles and coordinates networks of individuals and organizations to undertake change.</td>
<td>Who can make rules/management ideas/policies for how reef tourism workers access and use the reefs? Can you provide an example of a time you did this?</td>
<td>Respondents may give an example of a new intervention such as new rules, financing strategies, collaborative processes, MPA closures, or other interventions that are different from what was done previously for management. They may have initiated this idea, or supported peers to do so. There may have been costs or risks to promoting these responses, and they may have had to network in order to get their desired policy response passed. Respondents may give an example of using a story or narrative to convince their peers to adopt their ideas. These could involve moral reasoning, the need to respond to a crisis, or any other narrative to support or spread information about why their desired management change is necessary.</td>
</tr>
<tr>
<td>Policy entrepreneurs tell simple and persuasive stories about policy innovations.</td>
<td>How do MPA managers convince their fellow managers to buy into their ideas? Can you provide an example of a time you did this?</td>
<td>Respondents may give an example of how the management adjustment/policy response they sought was practical, simple, easy, or natural to implement.</td>
</tr>
<tr>
<td>Policy entrepreneurs present feasible policy innovations at an opportune time.</td>
<td>Does the MPA support stakeholders who want to intervene for conservation in innovative or creative ways? Can you provide an example of a time you did this?</td>
<td>Respondents may note how they used 1) a crisis, 2) an event where major actors were discussing the need for an intervention, or 3) a period of general agreement over a proposed action, to enact policy change.</td>
</tr>
<tr>
<td>Policy entrepreneur adapt to a problem during a period of heightened attention paid to that problem.</td>
<td>How does the reef management organization respond to crises? Can you provide an example of a time you did this?</td>
<td></td>
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</table>
Appendix C. Survey questions and explanations of why they were asked in interviews

<table>
<thead>
<tr>
<th>Question</th>
<th>Why this question was asked</th>
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</thead>
<tbody>
<tr>
<td>MPA managers believe that if they have new ideas for management, they can share those ideas in regular meetings. Answer choices: agree, disagree, do not know, or skip.</td>
<td>This question deals with the concept of policy innovation, where an actor is responsible for a radical change that they initiate, diffuse, and possibly evaluate. This question deals with the concept of a policy entrepreneur telling simple and persuasive stories about policy innovations.</td>
</tr>
<tr>
<td>MPA managers believe that they need to tell a story about proposed interventions, and convince their fellow managers to buy into stories. Answer choices: agree, disagree, do not know, or skip.</td>
<td>This question deals with the concept of a policy entrepreneur presenting feasible policy innovations at an opportune time. This question deals with the concept of a policy entrepreneur that adapts to a problem during a period of heightened attention paid to that problem.</td>
</tr>
<tr>
<td>MPA managers see stressors as an opportunity to exploit to improve management. Answer choices: agree, disagree, do not know, or skip.</td>
<td>This question deals with the concept of a policy entrepreneur that adapts to a problem during a period of heightened attention paid to that problem.</td>
</tr>
<tr>
<td>MPA managers believe that they need to tell a story about proposed interventions, and convince their fellow managers to buy into stories. Answer choices: agree, disagree, do not know, or skip.</td>
<td>This question deals with the concept of a policy entrepreneur that adapts to a problem during a period of heightened attention paid to that problem.</td>
</tr>
</tbody>
</table>

References


Skipped as an answer choice following feedback from respondents that local customs dictate that answering “I don’t know” may be undesirable to people in this area because it does not allow the respondent to save face.