Integrating Top-Down and Bottom-Up Adaptation Planning to Build Adaptive Capacity: A Structured Learning Approach

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Climate adaptation planning provides an opportunity to enhance the adaptive capacity of stakeholders across multiple levels. However, reviews of standard top-down and bottom-up approaches indicate that the value of multistakeholder involvement is not fully recognized or incorporated into guidelines. Focusing on provinces in Indonesia and Papua New Guinea within the Coral Triangle region, we present a novel integrated top-down and bottom-up planning approach. Based on Participatory Systemic Inquiry the process involves three stages of workshops intentionally designed to promote social learning, knowledge exchange, empowerment and social networks among multilevel stakeholders. Stage 1 workshops engage government, nongovernment and science stakeholders at the provincial level to analyze sub-districts' vulnerability and design appropriate adaptation strategies. Stage 2 engages local government, non-government and community stakeholders within vulnerable sub-districts identified in Stage 1. Stage 3 combines Stage 1 and 2 stakeholders to refine adaptation strategies and design action plans for sub-districts. Evaluation demonstrated that different stakeholder groups' perceptions of community adaptation needs varied significantly, justifying the approach. In terms of adaptive

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capacity, the primary outcome for all stakeholder groups was innovative ideas, suggesting that social learning and knowledge exchange had occurred. Empowerment was a secondary outcome. We discuss how the approach could be further refined.

Introduction

Because climate change impacts will largely be experienced at the local level, adaptation is often framed as a community issue (Preston, Mustelin, and Maloney 2013). However, the design, implementation, and scaling-up of adaptation strategies requires the knowledge and resources provided by other stakeholders including government and civil society (Adger, Arnell, and Tompkins 2005; Schipper et al. 2014). In addition, many of the barriers to adaptation exist within the institutional and political contexts that govern communities, particularly in developing countries (Lemos et al. 2007; Scoones 2009; Cannon and Müller-Mahn 2010; Ensor 2011).

Consequently, adaptation planning should build the adaptive capacity of all stakeholders to respond to climate change. Adaptive capacity can therefore be defined as "the potential for actors within a system to respond to changes, and to create changes in that system" (Chapin et al. 2006, 16641). Key attributes of adaptive capacity are social learning and knowledge exchange, empowerment and "bridging" social networks that link stakeholders and their resources across administrative levels and spatial scales (Smit and Wandel 2006; Armitage and Plummer 2010). When integrated, these facets promote knowledge diversity necessary to address complex problems (Folke 2004), collaborative and inclusive governance, which is reflexive to change (Carlsson and Sandström 2008; Armitage and Plummer 2010), and collective action (Brown 2008).

Enhancing adaptive capacity therefore requires the engagement of multilevel stakeholders in participatory learning and decision-making (Pahl-Wostl 2009). However, to be effective these processes must be carefully designed, and should also account for power dynamics among stakeholders (Ballard 2005). For example, power differentials between governing elites and local communities can impede equitable knowledge exchange and decision-making (Armitage, Marschke, and Plummer 2008). Stakeholder groups have differing constructions of reality or "knowledge cultures," and communities' local knowledge has the least credibility among other actors (Brown 2008). Hence, unless anticipated and mitigated, the politics of participatory processes can maintain or even exacerbate the vulnerability of communities (Burns 2014).

To date, the benefits and risks of participatory multistakeholder processes have not been fully accounted for in the design of adaptation planning in developing countries (Fazey et al. 2010; Butler et al. 2014a; 2014b; Conway and Mustelin 2014). There are two standard approaches. "Top-down" planning involves government-level decision-making based on long-term regional climate change modeling and impact projections, and adaptation strategies identified through technocratic cost–benefit analyses (Kelly and Adger 2000). This has evolved through National Adaptation Programmes of Action to include stakeholders from national to local levels (UNDP 2010). By contrast, "bottom-up" community-based vulnerability and adaptation (CVA) aims to empower communities by encouraging self-assessment of climate impacts through Participatory Rural Appraisal (PRA) methods (van Aalst, Cannon, and Burton 2008).

Both approaches have strengths and weaknesses. Top-down planning is sector-based, and cannot easily incorporate community priorities (Sherman and Ford 2013). However,

higher-level government and nongovernmental organization (NGO) stakeholders are more aware of long-term global drivers that communities cannot easily conceptualize, and they can deliver appropriate strategic responses. They also have the mandate and resources to create and change policy that enables local-level decision-making (Adger, Arnell, and Tompkins 2005). Community-based PRA can empower marginalized individuals (Chambers 2012), but a local focus fails to incorporate influences from higher scales (Scoones 2009). Consequently strategies are influenced by community members' narrow experience of local drivers and their immediate needs, and are constrained by their limited power (Conway and Mustelin 2014).

Hence there are potential complementarities between the strengths of these approaches, which if exploited could foster greater adaptive capacity than either may achieve in isolation. However, a review of nine CVA toolkits targeted at developing countries suggests that multilevel stakeholder involvement is limited, and processes are not intentionally designed to promote learning and power-sharing among these stakeholders (Table 1). Only Turnbull, Sterrett, and Hilleboe (2013) and Marshall et al. (2010) identify the need to foster synergies across stakeholder levels and to draw on diverse sources of knowledge, but neither provide guidance on how to achieve this, or consider potential power dynamics among stakeholders. Cundill et al. (2014) provide a handbook for social learning, but this is only targeted at the community level. Furthermore, although guidelines for top-down approaches recommend stakeholder analysis and community engagement (UNDP 2010), a recent review concluded that these processes still prioritize government and expert stakeholders' agendas (Sherman and Ford 2013). In the case of the UNDP (2010), design principles which can generate social learning, knowledge exchange and power-sharing are not considered.

In this article we present a novel planning approach that integrates the strengths of top-down and bottom-up adaptation. We describe the process and methods that are designed to build adaptive capacity among multilevel stakeholders while mitigating potential power and knowledge inequalities. Using five coastal case studies within the Coral Triangle in Indonesia and Papua New Guinea (PNG), we present data that justifies and evaluates this approach, and discuss lessons learned and potential refinements.

Methods

Study Areas Areas

The Coral Triangle is a marine biodiversity hotspot covering the developing nations of the Philippines, Malaysia, Indonesia, Timor Leste, Papua New Guinea, and the Solomon Islands (Coral Triangle Secretariat 2009). The region is characterized by coastal communities that are highly exposed to climate change (Hoegh-Guldberg et al. 2009), and low levels of adaptive capacity among all stakeholders (Butler et al. 2014a; 2014b). However, other drivers such as population growth and cultural change are also having complex and accelerating impacts on community vulnerability (Fazey et al. 2011; Butler et al. 2014a; 2014b). Adaptation planning has been prioritized for these communities by the Coral Triangle Initiative (Coral Triangle Secretariat 2011), and two toolkits have been specifically designed for this purpose (Table 1). From 2011–2013 we tested our planning approach by focusing on five coastal subdistricts in the provinces of Nusa Tenggara Barat Province (NTB), Indonesia, and West New Britain (WNB), PNG (Figure 1).

Table 1

Analysis of nine community-based vulnerability and adaptation assessment toolkits

Title	Reference	Target audience	Approach to multistakeholder involvement, knowledge, and power
Community-Based Adaptation Toolkit	Care International 2010	CVA project teams	- Include institutional and stakeholder analysis - Include technical experts and local organizations in analysis team - Present results to stakeholders to promote dialogue and awareness
A Framework for Social Adaptation to Climate Change: Sustaining Tropical Coastal Communities and Industries	Marshall et al. 2010	Tropical marine resource managers and conservationists	- Consider potential cross-scale interactions and feedbacks in the analysis - Develop partnerships between stakeholder groups at a local, regional, national and international level to share costs of change
Participatory Tools and Techniques for Assessing Climate Change Impacts And Exploring Adaptation Options	Regmi et al. 2010	Communities and forest NGO staff	- Map institutional context to identify partnerships for implementation of local adaptation plans
PACE-SD Guidebook: Participatory Vulnerability and Adaptation Assessment	Limalevu and and McNamara 2012	Communities	- Include climate expertise in assessment team for awareness-raising
Indonesian Climate Adaptation Tool for Coastal Habitats (I-CATCH)	USAID-IMACS Indonesia 2012	Government and NGOs	- Include local NGOs, government and university in assessment teams - Present action plans to government for endorsement and integration

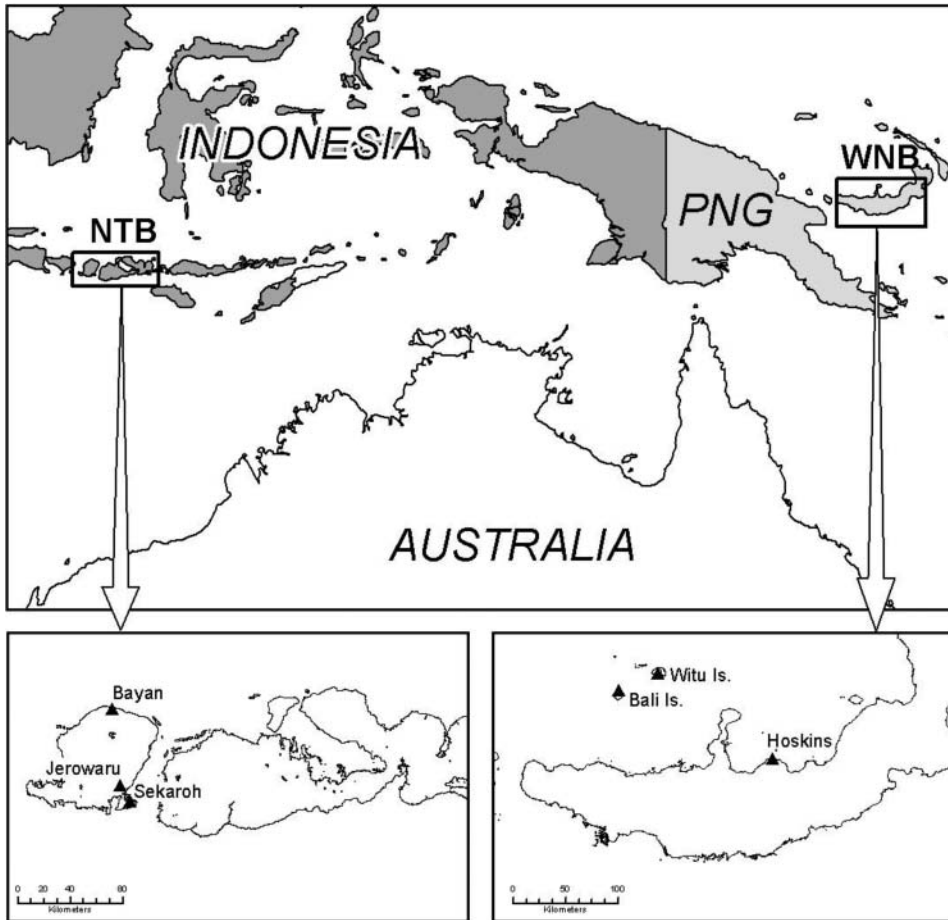| Title	Source	Audience	Recommendations
Toward Resilience: A Guide to Disaster Risk Reduction and Climate Change Adaptation	Turnbull, Sterrett, and Hilleboe 2013	NGO staff and partners	- Agree among the main stakeholders the purpose of analysis - Foster synergy between multiple levels - Draw and build on diverse sources of knowledge
Climate Change Adaptation for Coral Triangle Communities: A Guide for Vulnerability Assessment and Local Early Action Planning (LEAP Guide)	US Coral Triangle Initiative Support Program 2013	Governments, marine and disaster managers, community development practitioners	- Include experts and partners in Climate Change Adaptation Planning Team - Present LEAP to local stakeholders including government
Community-Driven Vulnerability Evaluation: A Handbook Incorporating Vulnerability to Climate Change into Project Design and Implementation	Watershed Organisation Trust 2013	Development project planners	- Include secondary stakeholders from village-level government in vulnerability context analysis - Include experts in data collection - Substantiate community data through experts' analytical capacity
Social Learning for Adaptation: A Descriptive Handbook for Practitioners and Action Researchers	Cundill et al. 2014	NGO practitioners	- Include facilitators in learning and sharing of knowledge

Figure 1. Case studies in Nusa Tenggara Barat Province (NTB), Indonesia, and West New Britain Province (WNB), Papua New Guinea (PNG). The Bali and Witu Islands together form one subdistrict.

Planning Approach

The approach applied the principles of Participatory Systemic Inquiry (PSI), defined as "learning and deliberation which involves multiple stakeholders in generating deep insights into the dynamics of the systems that they are trying to change" (Burns 2012, 88). The "system" concerned is the web of causal relationships between issues that stakeholders are concerned about, and embedded within. Unlike PRA, PSI is a structured learning process designed by researchers to enable multilevel stakeholders to see the system from perspectives other than their own. PSI forms the first stage of "sense-making," from which strategies for action are identified (Burns 2014).

We categorized stakeholders in NTB and WNB according to their roles, and Brown's (2008) related knowledge cultures: government (strategic knowledge), community (local knowledge), and nongovernmental organizations (NGOs; holistic knowledge). The research teams, consisting of local and Australian multidisciplinary scientists, contributed specialized knowledge. Because climate change interacts with other social and ecological

drivers in the Coral Triangle, we considered the system to include all issues influencing community vulnerability, defined as the degree that communities will be impacted by change, mediated by their adaptive capacity (Smit and Wandel 2006). PSI outputs were "no regrets" adaptation strategies for communities, defined as strategies that are flexible enough to yield benefits under any future conditions of change (Hallegatte 2009).

Planning Stages

The process involved three stages of 2–3-day workshops in each province (Figure 2). Stage 1 was a provincial-level workshop which engaged stakeholders from national and provincial government and NGOs to assess the relative vulnerability of sub-districts (*kecamatan* in NTB and Local Level Governments in WNB). Stage 2 focused on vulnerable coastal sub-districts prioritized in Stage 1. Separate workshops were held for each sub-district, engaging local government, local NGOs, and community stakeholders to assess the relative vulnerability of villages (*desa* in NTB and wards in WNB) within each sub-district. Outputs of Stage 1 and 2 were strategies targeting the causes of vulnerability in sub-districts and villages, respectively.

Stage 3 integrated the Stage 1 and 2 workshop participants and outputs (Figure 2). Final outputs were prioritized strategies for each sub-district, a comparison between the strategies and current or planned development programs, and an action plan that addressed the gaps and barriers to implementation. For detailed examples of workshop design and processes, see Butler et al. (2012a; 2012b; 2013).

Workshop Preparation

Prior to Stage 1 and 2 workshops, the research team carried out a stakeholder analysis. Following Burns (2012), a snow-balling method was applied to identify individuals with responsibility for and knowledge of community development and natural resource management at the administrative level concerned. This resulted in large numbers of potential participants. To prioritize them, we scored each stakeholder on a scale of 1–5 against Mitchell, Agle, and Wood's (1997) three salience criteria (power of the stakeholder; stakeholder's legitimacy as viewed by others; urgency that the stakeholder claims involvement). The 30 stakeholders with the highest cumulative scores were invited. The team also collated available climate change projections, mapping of coastal inundation risk, demographic data and projections, and economic trends for workshop discussion (Butler et al. in review). A list of ecosystem goods and services underpinning livelihoods in each sub-district was also made through key informants and local expert opinion for ranking during the workshops (Rochester et al. in review; Skewes et al. in review).

Preparation for Stage 3 involved selection of participants from the Stage 1 and 2 workshops with the highest stakeholder analysis scores. Thirty were invited, with 10 from Stage 1 and 20 from Stage 2 to ensure community representation. As a result, in four of the five workshops community stakeholders formed the majority of questionnaire respondents (Table 2). Participants from Stage 1 and 2 were selected to present results from their workshops, assisted by the research teams. The Stage 2 representative was always a community leader. Individuals (previous participants or others) who could provide expert input on strategies identified during Stage 1 and 2 were also invited. Details of all current or planned development programs for the sub-district were collated for discussion.
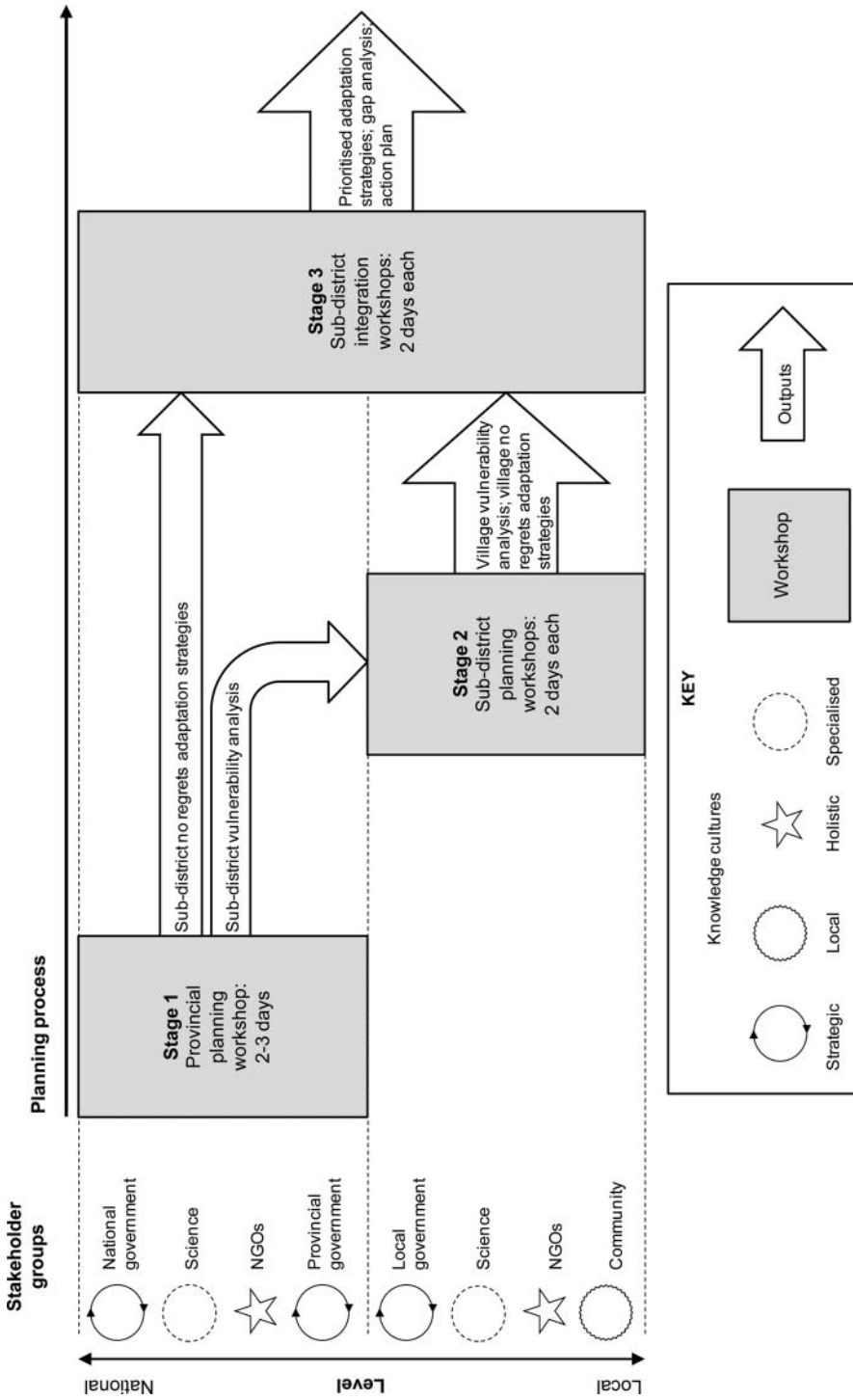
Figure 2. The three-stage integrated top-down and bottom-up adaptation planning process and outputs, showing the stakeholder groups and their knowledge cultures engaged in each stage.

Table 2
Questionnaire respondents in each stakeholder group for the Stage 3 workshops

Sub-district	Stakeholder groups			Total
	Community	Government	NGOs	
a) Nusa Tenggara Barat				
Bayan	9	14	2	25
Jerowaru	13	9	4	26
Sekaroh	18	11	3	32
b) West New Britain				
Hoskins	13	8	8	29
Bali-Witu	19	9	1	29
Total	72	51	18	141

Workshop Learning Steps

Workshop processes adapted Brown's (2008) decision-into-practice learning steps. These enable stakeholders and their knowledge cultures to "move together in an interactive, iterative process in which everyone enhances the understanding of everyone else" (Brown 2008, 48). Referring to the system and problem concerned, four questions are addressed in succession: "what is?," "what should be?," "what could be?," and "what can be?" (Figure 3). Workshop sessions posed these questions in terms of community vulnerability, livelihoods, and adaptation (Figure 4). The Stage 1 and 2 workshops followed the same format, and the Stage 3 workshops reviewed their processes and outputs before developing an action plan, which provided another cycle of Brown's (2008) learning steps. Sessions applied standard PRA learning methods (see Chambers 2012), including focus group discussions with mixed stakeholder group representation, ranking, scenario drawing, and matrix gap analysis.

Mitigating Power Dynamics

To ensure that stakeholder's views were weighted equally, in the Stage 1 and 2 workshops participants ranked drivers of change, the adaptive capacity of sub-districts or
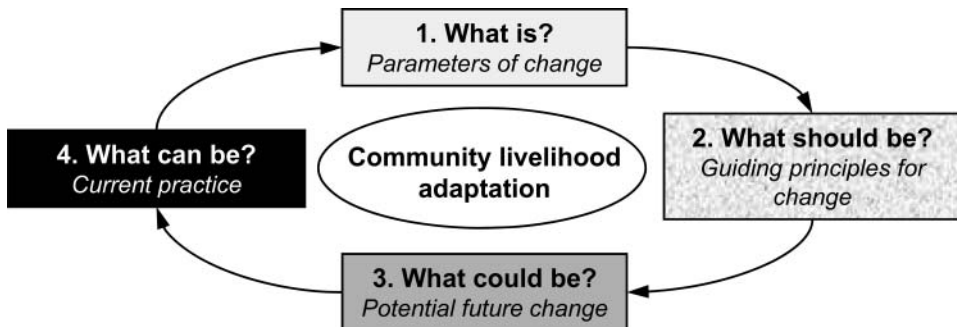

Figure 3. Brown's (2008) decision-into-practice learning steps, framed for community livelihood adaptation. See Figure 4 for their application in the workshop sessions.
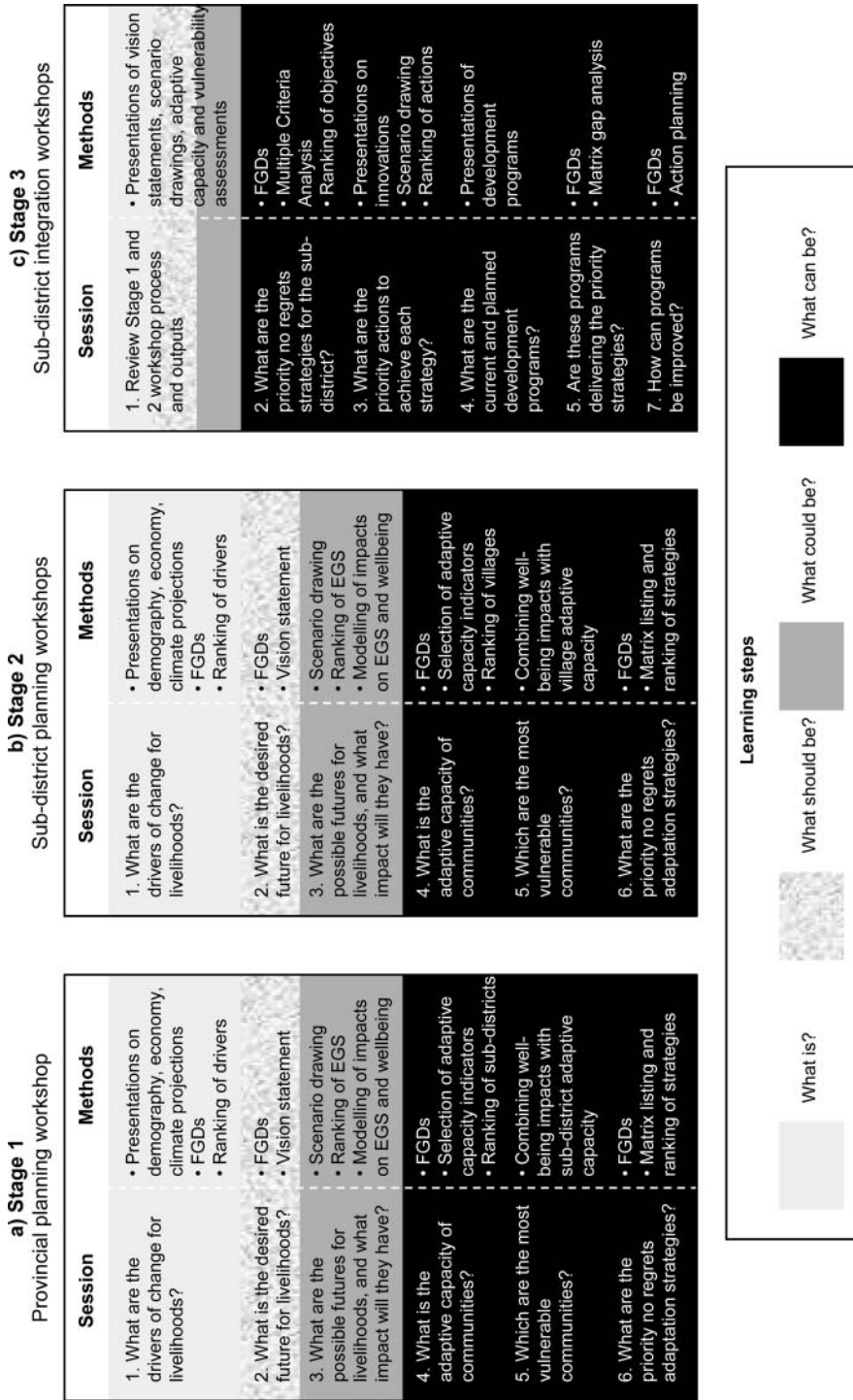
a) Stage 1
Provincial planning workshop

Session	Methods
1. What are the drivers of change for livelihoods?	• Presentations on demography, economy, climate projections • FGDs • Ranking of drivers
2. What is the desired future for livelihoods?	• FGDs • Vision statement
3. What are the possible futures for livelihoods, and what impact will they have?	• Scenario drawing • Ranking of EGS • Modelling of impacts on EGS and wellbeing
4. What is the adaptive capacity of communities?	• FGDs • Selection of adaptive capacity indicators • Ranking of sub-districts
5. Which are the most vulnerable communities?	• Combining well-being impacts with sub-district adaptive capacity
6. What are the priority no regrets adaptation strategies?	• FGDs • Matrix listing and ranking of strategies

b) Stage 2
Sub-district planning workshops

Session	Methods
1. What are the drivers of change for livelihoods?	• Presentations on demography, economy, climate projections • FGDs • Ranking of drivers
2. What is the desired future for livelihoods?	• FGDs • Vision statement
3. What are the possible futures for livelihoods, and what impact will they have?	• Scenario drawing • Ranking of EGS • Modelling of impacts on EGS and wellbeing
4. What is the adaptive capacity of communities?	• FGDs • Selection of adaptive capacity indicators • Ranking of villages
5. Which are the most vulnerable communities?	• Combining well-being impacts with village adaptive capacity
6. What are the priority no regrets adaptation strategies?	• FGDs • Matrix listing and ranking of strategies

c) Stage 3
Sub-district integration workshops

Session	Methods
1. Review Stage 1 and 2 workshop process and outputs	• Presentations of vision statements, scenario drawings, adaptive capacity and vulnerability assessments
2. What are the priority no regrets strategies for the sub-district?	• FGDs • Multiple Criteria Analysis • Ranking of objectives
3. What are the priority actions to achieve each strategy?	• Presentations on innovations • Scenario drawing • Ranking of actions
4. What are the current and planned development programs?	• Presentations of development programs
5. Are these programs delivering the priority strategies?	• FGDs • Matrix gap analysis
7. How can programs be improved?	• FGDs • Action planning

Learning steps

What is? · What should be? · What could be? · What can be?

Figure 4. Sessions, learning steps and methods used in (a) Stage 1, (b) Stage 2, and (c) Stage 3 workshops. FGD denotes focus group discussions, and EGS denotes ecosystem goods and services.

villages, and the value of ecosystem goods and services individually (Skewes et al. in review). Because a trusted and independent facilitator is critical for managing power dynamics and brokering knowledge (Chambers 2012; Buchanan et al. 2013; Burns 2014), the same facilitator ran all workshops in each province. In addition, the project team was coached by the facilitator to mediate focus group discussions involving mixed stakeholders.

Evaluating Stakeholders' Perceptions

To examine stakeholder groups' perceptions of community adaptation, we conducted a questionnaire survey of participants at the beginning of each Stage 3 workshop. Participants were asked to identify communities' greatest livelihood challenges and necessary adaptation strategies. The second question was designed to assess whether stakeholders prioritized incremental (i.e., adjusting existing livelihoods) or more transformational strategies (i.e. addressing underlying systemic issues: Lemos et al. 2007) in three domains: production systems (agriculture, fisheries, aquaculture and forests), economy (cash, bartering and subsistence), and institutions (leadership, rules and governance).

To evaluate the processes' influence on adaptive capacity, at the completion of Stage 3 workshops we conducted a second questionnaire. Questions were designed to assess the extent that attributes of adaptive capacity had emerged: social learning and knowledge exchange (indicated by innovative ideas and new information), empowerment, and bridging social networks (indicated by new contacts, partnerships, and sources of funds).

If stakeholders had attended multiple Stage 3 workshops, we only included responses from their first questionnaire to avoid duplication. Responses for each stakeholder group were aggregated, and also combined from NTB and WNB to maximize the sample size for statistical analysis. Fisher's Exact Test was applied to assess whether stakeholder groups' responses differed significantly.

Results

Overall, 141 stakeholders were surveyed, of which 72 (51%) were community, 51 (36%) were government, and 18 (13%) were NGO participants (Table 2). Between 95% and 100% of participants in each workshop completed questionnaires, but not all questions were answered by all respondents.

Perceptions of Adaptation

A wide range of livelihood challenges was identified (Figure 5). The frequency of themes varied significantly between stakeholder groups ($\phi = 0.24$, $p = .10$). Relative to community and government stakeholders, almost double the proportion of NGO respondents considered poor government investment and infrastructure as the primary challenge. A higher proportion of government and NGO stakeholders viewed unsustainable resource use as a problem than did community stakeholders. Climate variability and food and water security were considered more important by community and government respondents than by NGOs.

For the production systems and economy domains of adaptation strategies, the majority of community, government, and NGO stakeholders prioritized incremental strategies, and there were no statistically significant differences between the groups. For the institutions domain, the majority of community and government stakeholders prioritized
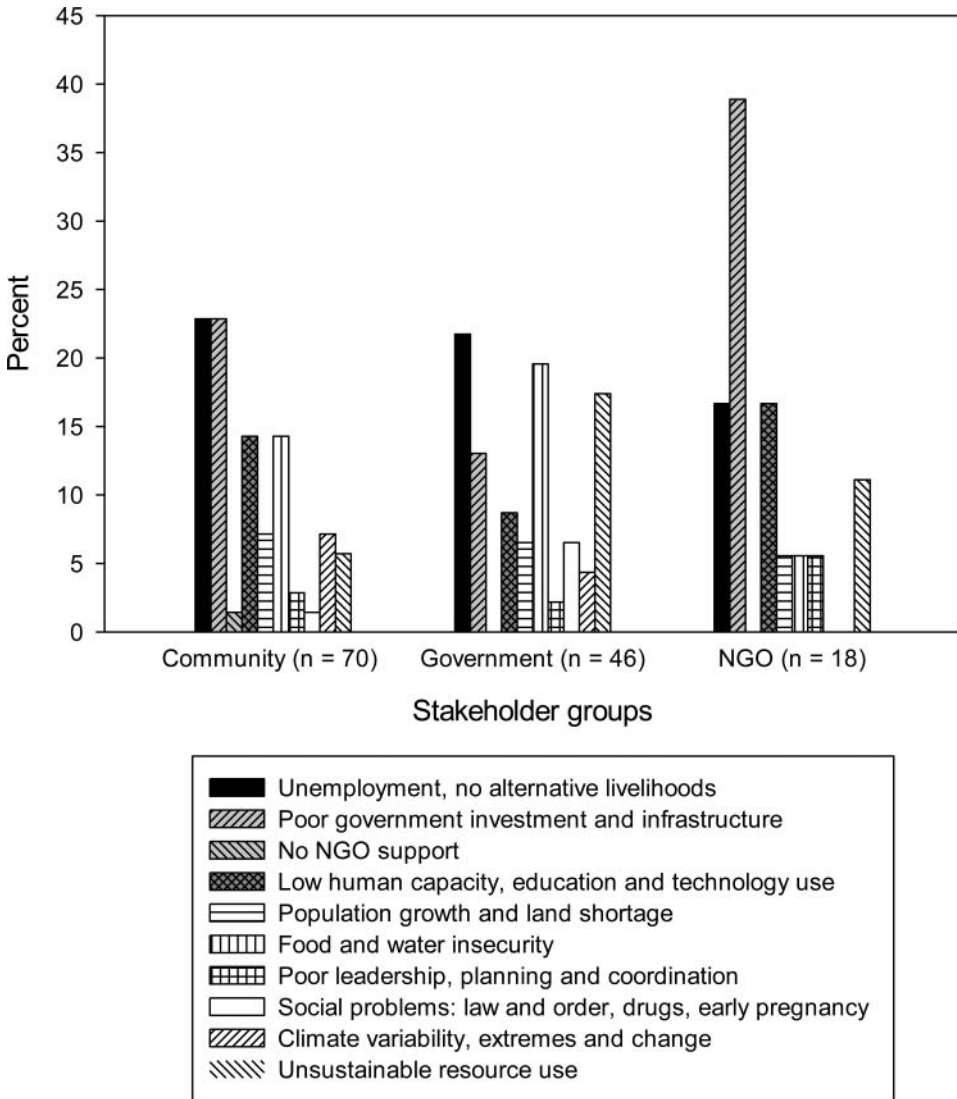
Figure 5. Questionnaire respondents' answers to the question "What is the greatest challenge for communities' livelihoods in the sub-district?," aggregated by theme and stakeholder group.

incremental strategies, but the majority of NGO stakeholders selected transformational strategies through the balancing of traditional values and practices with current government structures. These differences were statistically significant (Table 3).

Adaptive Capacity

The large majority of all stakeholder groups considered innovative ideas as the most important outcome, but new information was comparatively unimportant (Figure 6). Empowerment was the second most important outcome for all stakeholder groups. New contacts were only mentioned as an outcome by a small minority of government stakeholders. However, when asked if they had identified potential new partners who could

Table 3

Questionnaire respondents' answers to the three questions on necessary adaptation strategies, presented according to domains (production systems, economy, and institutions) and stakeholder group

Adaptation strategies	Community (n = 70)	Government (n = 46)	NGO (n = 18)
a) Production systems[n.s]			
Improve current production systems	64%	63%	61%
Change to different production systems	36%	37%	39%
b) Economy[n.s.]			
Increase cash income from current livelihood activities	54%	67%	56%
Balance cash income with subsistence and traditional bartering	46%	33%	44%
c) Institutions[*]			
Improve behaviour of current leaders and government	69%	63%	39%
Balance traditional values and practices with current government structures	31%	37%	61%

n.s. = No statistically significant difference.
*Statistically significant difference ($\phi = 0.20$, $p = .073$).
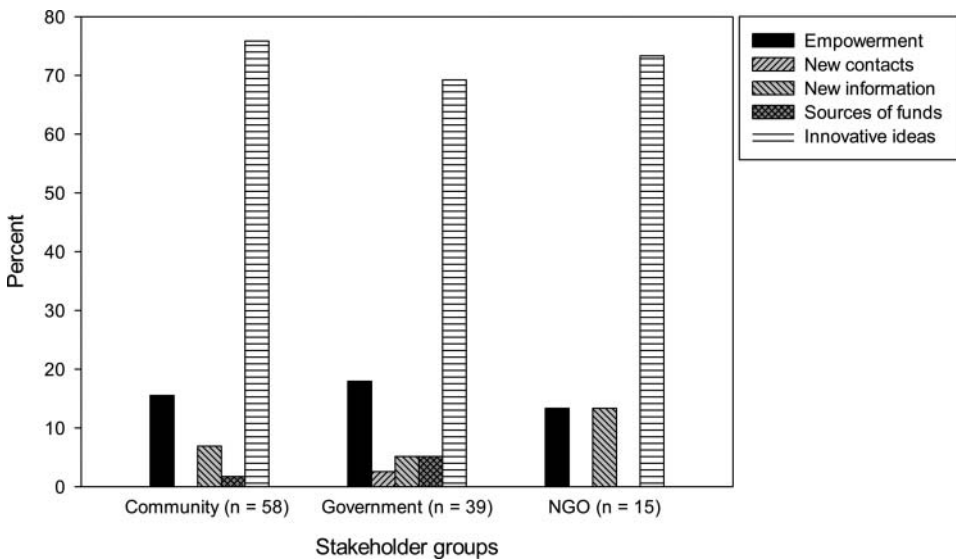
Figure 6. Questionnaire respondents' answers to the question "What is the most important thing you have gained from this and previous workshops?," presented according to stakeholder group.

Table 4

Summary of the strengths, weaknesses, and suggested refinements for the integrated planning approach

Adaptive capacity attributes	Strengths	Weaknesses	Refinements
Social learning and knowledge exchange	- PSI enables a systems understanding - Integrates multilevel stakeholders and their varied perceptions and knowledge cultures - Decision-into-practice learning steps in Stage 1 and 2 workshops enable individual and group reflection - Learning steps repeated in Stage 3 workshops	- PSI process designed by researchers, limiting participants' input - Risk of power asymmetries between community and other stakeholders - Not all Stage 1 and 2 participants included in Stage 3 workshops, limiting learning	- Apply PRA methods to enhance participants' involvement (see Empowerment) - Anticipate and mitigate potential power dynamics (see Empowerment) - Provide immediate and regular feedback to all participants to maintain engagement
Empowerment	- Community representatives engaged in Stage 2 - Community representation in Stage 3 workshops ensured by selecting 20 Stage 2 participants - PRA learning methods enable participants' involvement - Ranking methods weight all participants' views equally - Formal and consistent use of a skilled facilitator to anticipate and mitigate power dynamics - Research team coached to manage power dynamics	- Marginalized community members possibly excluded by stakeholder analysis - Bias towards most powerful stakeholders in Stage 3 workshops	- Modify stakeholder salience criteria for Stage 2 workshops - Include less powerful stakeholders in Stage 3 workshops
Cross-scale social networks	- Three stage process of 2–3 day workshops provides time for relationships to develop	- Networks and new partnerships take a long time to evolve	- Monitoring and evaluation necessary to track social networks post-Stage 3

help the community to adapt, the large majority of community (89%), government (95%), and NGOs (93%) agreed. There were no statistically significant differences between the groups.

Discussion

Adaptation planning provides an opportunity to build the capacity of multiple stakeholders, and hence the system they are embedded within. If integrated, the strengths of top-down and bottom-up planning could generate greater adaptive capacity than either may achieve in isolation. Our review of nine CVA toolkits suggests that suggests that multi-level stakeholder involvement is limited, and processes are not intentionally designed to promote learning and power-sharing among these stakeholders. Furthermore, although top-down approaches have attempted to include community stakeholders, this has often proved problematic (Sherman and Ford 2013), and planning guidelines (e.g. UNDP 2010) do not yet consider design principles which foster social learning, knowledge exchange and power-sharing.

Notably, two CVA toolkits developed specifically for the Coral Triangle (USAID-IMACS Indonesia 2012; U.S. Coral Triangle Initiative Support Program 2013) have not been designed to maximize the potential benefits of multilevel stakeholder engagement. Although both recommend the inclusion of various experts, NGOs and other non-community stakeholders in assessment teams, and propose the presentation of adaptation plans to local governments, neither apply a formal learning process. Having been successfully trialed in coastal Indonesia and PNG, our integrated approach may add value to adaptation planning in this region, where adaptive capacity is low at all levels (Butler et al. 2014a; 2014b). In addition, although many communities are highly exposed to climate change (Hoegh-Guldberg et al. 2009), other drivers such as population growth and cultural change are interacting with climatic factors to generate greater complexity and uncertainty, and multiple stakeholders' knowledge and resources are necessary to understand these issues and formulate no regrets adaptation strategies (Butler et al. 2014a; 2014b). The systems-based approach of PSI assists this analysis, and also enables the identification of underlying, systemic causes of vulnerability and the transformational strategies required to address them (Burns 2012; 2014).

The evaluation results highlight the diverse perceptions of stakeholders, justifying their inclusion in the process. Community, government, and NGO respondents' views of livelihood challenges differed significantly. The relative importance of incremental versus transformational adaptation strategies in the production systems and economy domains were similar between stakeholder groups. However, for the institutional domain NGO respondents differed by prioritizing transformational strategies that balance traditional values and practices with current government structures. Furthermore, the full diversity of perspectives was probably masked by the aggregation of responses into stakeholder groups.

The results are also consistent with the characteristics of Brown's (2008) knowledge cultures. NGOs regarded institutional transformation as an important adaptation strategy, reflecting holistic knowledge (Brown 2008). This also suggests that NGOs recognize the need to tackle institutional and governance issues, which can be a root cause of community vulnerability in developing countries (Lemos et al. 2007; Scoones 2009; Cannon and Müller-Mahn 2010; Butler et al. 2014a). Government and NGO respondents also perceived unsustainable resource use as a livelihood challenge, suggesting a more objective perspective typical of their strategic and holistic knowledge cultures, respectively (Brown 2008).

Adaptive capacity outcomes were equally evident for all stakeholder groups. This is notable for community stakeholders, who could have been marginalized by the process and hence failed to benefit. The workshops most successfully promoted social learning and knowledge exchange, as indicated by the majority of respondents stating that they had gained innovative ideas. Empowerment was the second most important outcome. Although new contacts and sources of funds were the weakest outcomes, suggesting limited establishment of bridging social networks, when asked if they had identified potential new partners to assist community adaptation, the large majority of respondents agreed. This may be explained by the fact that social networks and resulting collective action and collaborative governance evolve slowly (Armitage and Plummer 2010; Burns 2012; Plummer 2013). Hence the workshops may only have created the pre-conditions for this attribute of adaptive capacity to emerge. This highlights the need for monitoring following Stage 3 to track the evolution of collaborative arrangements and the implementation of adaptation strategies, and whether the conditions for such collaboration are being maintained (Butler et al. 2014a; Butler et al. in review).

Reflecting on the lessons learned and evaluation results, we detail the strengths, weaknesses and suggested refinements for our integrated approach in Table 4. In terms of the adaptive capacity attributes, the approach primarily fostered social learning and knowledge exchange, followed by empowerment of all stakeholders, and social networks. For social learning and knowledge exchange one weakness was the PSI framework, which is researcher-driven (Burns 2012) and potentially contradicts community-based planning principles advocated by PRA (Chambers 2012) and VCA (van Aalst, Cannon, and Burton 2008). While we mitigated this by employing PRA methods during workshops, further experimentation with a wider suite of tools is warranted. For empowerment, a weakness was the possible exclusion of the most marginalized members of communities through our stakeholder analysis, which emphasised salient actors with responsibility and knowledge of the system. This was exacerbated by the selection of higher-scoring participants from Stage 1 and 2 for the Stage 3 workshops. Participatory processes are fraught with risks of elite capture, mis-representation by leaders (Ballard 2005; Armitage, Marschke, and Plummer 2008) and communities' internal politics (Agrawal and Gibson 1999), and it is difficult to eliminate these factors. However, we suggest that these issues can be mitigated by applying a more nuanced stakeholder analysis and anticipation of potential power dynamics.

In conclusion, we have presented a novel integrated adaptation planning approach that offers an alternative to standard top-down and bottom-up CVA toolkits, and enhances adaptive capacity. By including multilevel stakeholders within a process intentionally designed to promote learning and mitigate power dynamics, social learning, knowledge exchange, empowerment, and social networks were promoted. The systems-based approach is particularly appropriate for the Coral Triangle because an equivalent does not yet exist in this region, and coastal communities are highly vulnerable to the complex and accelerating interactions between climate change and other drivers. We recommend that the approach is further tested and refined in other regions of the developing world, and that monitoring is undertaken following Stage 3 workshops to assess the emergence of social networks, collective action, and implementation of adaptation strategies.

Acknowledgments

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