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RESEARCH ARTICLE

From knowledge to action: multi-stakeholder planning for urban climate change adaptation and resilience in the Asia–Pacific

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Abstract

One of the most challenging aspects of urban climate change adaptation and resilience continues to be the act of translating knowledge about vulnerability into action for resilience. This paper distills efforts to develop a capacity building initiative for practitioners and stakeholders of urban climate change adaptation and resilience through applied locally contextual curriculum development, course implementation, and continued mentoring. Grounded in principles of participatory action research, the initiative worked with partners from 12 countries and more than 40 cities across South and Southeast Asia, and the Pacific Islands. The paper discusses the iterative evolution of the course, which was developed and refined over a period of 2 years and is now being implemented by international development agencies and organizations throughout these regions. Findings highlight the learning process undertaken, which led to the creation of a "goalpost to goalpost" framework for assisting municipal governments and associated stakeholders in developing a shared, policy-relevant, and institutionally grounded understanding of the localized physical processes and impacts associated with climate change. We also showcase the complexity therein, describing solution-oriented pathways for assessing and prioritizing vulnerabilities, designing an adaptation portfolio, and identifying sources of local, domestic, and international financing to support the implementation of policies and projects. The paper provides a number of lessons to inform capacity building efforts in addressing climate change impacts in diverse urban landscapes and serves as a strategy for policy formulation and adaptation project preparation across stakeholder groups.

Keywords Engaged methodologies · Resilience · Climate change adaptation · Disaster risk reduction · Participatory action research

1 Introduction: the climate impact challenge in urban resilience

The impacts of climate change on cities, and the need to adapt to these impacts, have been widely recognized at a global level both among the academic and international development communities (Brown et al. 2012; Bulkeley

We dedicate this paper to the memory of Kem Lowry, co-author and mentor, who will be remembered for his commitment and scholarship on engaged methodologies and practical approaches for building resilience.

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and Tuts 2013; Cannon and Muller-Mahn 2010; Carter et al. 2015; Friend et al. 2014; Valdes 2012). However, municipal policy agendas are crowded and in many cases securing local commitment to address climate change vulnerabilities poses a significant obstacle (Ahammad 2011; Carmin et al. 2012; Vink et al. 2013). Local planners and management staff in many cities lack basic knowledge of climate change processes and impacts. Another common problem is that planning staff do not know where to go to find information that can be used to develop policies and strategies which can then inform a comprehensive program of interventions and projects. The "silo" character of government agencies is cited as a significant impediment to the kind of multi-sectoral planning that is needed to address climate change over the long term and reduce damage from disasters over the short term (Carter et al. 2015). Additional challenges facing many urban officials include a lack of political influence, financial resources, and statutory authority to address climate change. Practical capacity gaps exist in developing comprehensive strategies to address vulnerabilities and subsequently finding finance for these interventions (Brugmann 2012). There is also lack of explicit training or commitment for public engagement (Healy and Booth, this issue). These challenges can lead to bureaucratic inertia widening gaps in adapting to climate change.

This paper examines the way training development, conducted through partnerships, targeted curriculum localization, and course delivery to multi-stakeholder representation in urban settings, can help to foster deliberate efforts for climate change adaptation and resilience planning. The authors of this paper consist of course development and delivery proponents with various affiliations in social science and technical departments at universities and development organizations. The team included experts in climate change adaptation and disaster risk reduction, local university researcher and NGO partners with local experts on political-economic and biophysical processes. We also continue to support programmatic implementation and networks through capacity building, mentoring, and learning events on urban climate change adaptation and resilience. The research draws from engagement with representatives and multi-stakeholder teams from over 40 municipalities across 12 countries, which were supported through two multi-year programmatic initiatives. This article is also part of a special issue on "Advancing scholarship and practice of stakeholder engagement in working landscapes" whereby we highlight the emerging complexities of climate change adaptation and resilience planning in diverse geographies. Specifically, we show how collaborative approaches in a structured learning environment affords opportunities to bring groups together to set the agenda in specific urban climate resilience contexts, while gleaning broader lessons at scale.

1.1 The urban climate adaptation and resilience planning challenge

Major efforts have been undertaken by international agencies, donor organizations [e.g., World Bank, Asian Development Bank], NGOs [e.g., Rockefeller Foundation's 100RC; the Asian Cities Climate Change Resilience Network ACCRN] (see Bahadur and Tanner 2014; Brown et al. 2012), bilateral development agencies [e.g., GIZ and USAID], and national/local government and local NGOs to build adaptive capacity and address the impacts of climate change through funding research, infrastructure development, and capacity strengthening. However, the scalability of these efforts remains to be seen, particularly given the recognition of the local contextual nature for adaptation to be successful. For example, the ACCCRN and 100RC projects, despite their significant merits, have only reached a limited number of cities and rely on a high degree of institutional investment up front. Meanwhile there has been a much more limited degree of progress in cities that have not received international assistance. Even with broad-based recognition at international and national levels to anticipate and respond to the impacts of climate change, the pioneering efforts to promote climate change adaptation in specific cities has not led to widespread dissemination among other cities (Bulkeley and Tuts 2013; Carter et al. 2015). In most places across the Asia–Pacific, for-example, aside from a few early adopters, most cities have still not adequately addressed climate change in planning, policy, and adaptation (Fuchs et al. 2011). Therefore, the clear challenge is how to recreate the conditions for successful adaptation in cities threatened by the impacts of climate change.

The literature is clear on the challenges of climate change adaptation and resilience planning, which requires approaches that addresses several key factors. First, although climate change is a global phenomenon, resilience-building initiatives must treat climate change as a local problem by assisting with the identification of locally relevant physical processes and impacts while crafting policy relevant climate change messages. Second, approaches need to better identify, work within the constraints of, and take advantage of opportunities afforded by existing local resources and expertise. Doing so can potentially help to transfer innovations to other cities. Third, approaches must improve ways to encourage stakeholder participation in collecting and leveraging "bottom-up" information on community-level vulnerabilities. Fourth, planning initiatives must better identify the most urgent adaptation needs, as well as targeting key opportunities for longer term transformative change. Finally, existing adaptation and resilience building successes need to be better identified and translated into effectively replicated and scaled up initiatives throughout the region.

2 Methods: a participatory approach to resilience planning through course development and delivery

Participatory action research (PAR) is a methodology that brings together different groups in the formulation and pursuit of research questions, which has been extended across various disciplines (McTaggart 1997). With grassroots origins, PAR also prioritizes the importance of praxis by combining research with applied initiatives to meaningfully engage stakeholder groups beyond a bounded initiative (Rappaport 2020). PAR origins can be traced to the broader literatures of participation, collaboration, and good governance (Emerson et al. 2017) and more recent work convenes around the heading of 'co-production of knowledge' (Acabado and Kwan 2021) that are rooted in particular geographies (Fisher 2021; Kindon et al. 2007). It is also ideally suited for working in diverse landscapes (Werkman et al. 2011; Ojha et al. 2013).

We applied PAR principles to address the locally situated contexts of climate change adaptation and resilience planning. We drew from the emerging literature on applied planning for resilience and worked to convene local stakeholders in a practitioner-oriented course. Diverse landscapes and institutional contexts afforded an applied setting for us to identify lessons and potential innovations in climate change adaptation and resilience planning. With support from international development funds, our research team convened stakeholder groups and extended emerging concepts of vulnerability, adaptation, and resilience, while also helping to translate these concepts into locally relevant concepts. Our approach to curriculum development took place alongside local university and government agencies, and actively involved civil society groups in the formulation and learning process. These stakeholders then convened to participate in the course and chart out next steps for implementing plans within their departments and communities. They would also have opportunities to benefit from continued mentoring support beyond a classroom and field study setting.

Two USAID projects were instrumental in providing the opportunity to implement this approach. The first of these, the Project Preparation Facility for the Asia–Pacific (*Adapt Asia–Pacific*[1]), served as a "regional project preparation facility to bridge capacity gaps and promote access to finance for adaptation projects." Over time, the *Adapt Asia–Pacific* program helped to mobilize several hundred million dollars in financing for adaptation projects throughout Asia and the Pacific via channels such as the Adaptation Fund, the Asian Development Bank, and several bilateral aid agencies. A major component of *Adapt Asia–Pacific* was to build capacity in national and subnational governments in terms of understanding climate change, assessing vulnerabilities, developing strategies and projects to address vulnerabilities, and identifying and accessing financing to support project implementation. To this end, the *Adapt Asia–Pacific* project helped to develop and implement a course entitled Urban Climate Change Adaptation and Resilience (UCCAR), which focused on challenges faced by second- and third-tier cities across Asia and the Pacific. The second project, the *Building Resilience Through Training* project, was funded through USAID's Office of Foreign Disaster Assistance (OFDA). One of its components supported universities in Indonesia to develop disaster risk reduction and climate change adaptation curricula to become regional knowledge hubs and training centers for building resilience to climate change and disasters. This program provided an opportunity to implement and revise the UCCAR course based on lessons learned through practice. It also provided longer-term mentoring opportunities and included efforts to institutionalize the course with local university and NGO partners. Our local partners translated course development outcomes into local agency climate adaptation and resilience plans, and universities applied the trainings in many cities.

The primary objectives of the course include the following:

- Introduction of a systems perspective for thinking about the impacts of climate change on cities;
- Developing an understanding of direct and indirect impacts of climate change that are locally specific and relevant to policy and decision-making processes;
- Providing a framework for selecting an appropriate methodology and conducting vulnerability assessments at different scales, ranging from neighborhoods to municipalities;
- Generating a potential portfolio of interventions to systematically address identified vulnerabilities;
- Providing tools and techniques to establish priorities and evaluative criteria to choose among adaptation options; and
- Providing an overview of financing options and the appropriate application of these options, including locally generated revenue, private sector support, and national and international grants and loans.

The process of designing modules and delivering trainings has been a complex, iterative learning endeavor which has seen numerous refinements to the course. Between 2013 and 2017, the project teams developed an understanding of

[1] Additional information on the USAID Adapt Asia Pacific program can be found here: https://www.usaid.gov/asia-regional/documents/adapt-asia-pacific. Materials produced for the *Adapt Asia–Pacific* project can be found at https://www.climatelinks.org/projects/adapt-asia-pacific.

how to identify participants, collaborate with multi-stakeholder partners, identify relevant issues, and apply conceptual and theoretical concepts in the context of local needs and capabilities. It also led to the overall lessons learned and key findings that are presented in this paper. The paper continues by describing course development in Sect. 3, laying out each of the seven steps for design and implementation and the iterative and collaborative learning process that led to our key results. The resulting lessons provide opportunities for scaling up climate adaptation and resilience planning through collaborative and participatory approaches to action learning in ways that respond to key stakeholders at the site/landscape level.

3 Results: course development approach and step-by-step iterative learning

The course evolved to reflect the experiences and expertise course proponents and participants. Iterations of the course ranged from 2 to 7 days, and generally averaged approximately 25 participants. Participants drew from multi-stakeholder audiences of various backgrounds from local government, universities, NGOs, and cultural or religious leadership organizations. The earliest incarnations of the course were critiqued as being too theoretical for the urban practitioners we sought to reach. Course revisions focused more heavily on the challenges confronted by local officials, but also on drawing lessons learned from the professional literature and scholarly analyses of resilience-building and adaptation experiences in the region. These revisions came out of the strong partnerships established with local universities that supported continued evaluation of outcomes, relevancy among local stakeholders, and supported advocacy for implementation. Part of this practical mindset is an orientation to process. We think in terms of "policy" and "project" realms with the idea that each municipality, region, province, or national government needs to develop a coherent strategy for addressing climate change, which then informs the design and implementation of projects and other interventions. We have learned that projects have a very small chance of attracting external support if they are not embedded in a broader adaptation and sustainable development framework. In many cases, cities seeking external support for designing and implementing adaptation projects must first design a guiding strategy. Because of this, the skills developed in the training course apply for both policy development and project design. This emphasis was arrived at after a comprehensive review of existing municipal level adaptation strategy documents as well as approved adaptation projects. This "goalpost to goalpost" framework is illustrated in Fig. 1.

The course is divided into several modules, each of which can and have been localized for the specific setting of implementation. Localization took place through deep engagement with local universities and research teams. We delivered either the entire course, or elements of the course to representatives of more than 40 municipalities and regions from twelve countries (Vietnam, Cambodia, Thailand, Bangladesh, Nepal, the Maldives, India, Indonesia, Pakistan, Sri Lanka, Singapore and the Philippines). This provided the opportunity to tailor curriculum materials for each of these countries. In addition, the course has been designed to be as flexible as possible to allow the addition of local training material, local experts, and site visits.

As originally designed, the course mixed instructor presentations and discussions with group exercises, with instruction amounting to about 60% of the course schedule. Over time, we put more emphasis on carefully tailored group activities. At the beginning of the training, participants were divided into working groups of 4–6 participants per group. These groups remained together throughout the course. Over multiple iterations of the course, the composition and order of activities evolved so that participants could engage in a coherent set of activities that built upon one another toward a municipal climate adaptation strategy. By the end of the training workshop, participants were expected to have a clear set of tasks that will lead to the development of a strategy. In the following subsections, we describe some of the lessons learned and innovations that have been incorporated into the course design.

3.1 Embracing the "systems" approach (step 1)

Many of the current approaches to building resilience to the impacts of climate change utilize a "systems" perspective (Da Silva et al. 2012; Tyler and Moench 2012). In general, the urban systems approach emphasizes the multi-sectoral and multi-scalar (both geographic and temporal) aspects of climate change as a threat facing cities and regions. Among the key messages of these approaches are that institutionally "siloed" approaches to adaptation are insufficient for addressing the complexity of climate change (Carter et al. 2015) and that adaptation actions implemented in one sector may in fact increase vulnerability in another sector (Dilling, et al. 2015). While this message resonates with scholars and development/NGO professionals, we have found that, in practice, it is more difficult to convey than it seems.

To overcome difficulties across sectors, we developed a simple visioning exercise whereby participants first describe the essential functions of their city (e.g., funding, building and maintaining roads and other transportation linkages) along with the agencies/institutions directly involved in providing those essential functions. Participants are then challenged to think more profoundly about the "purpose" of the

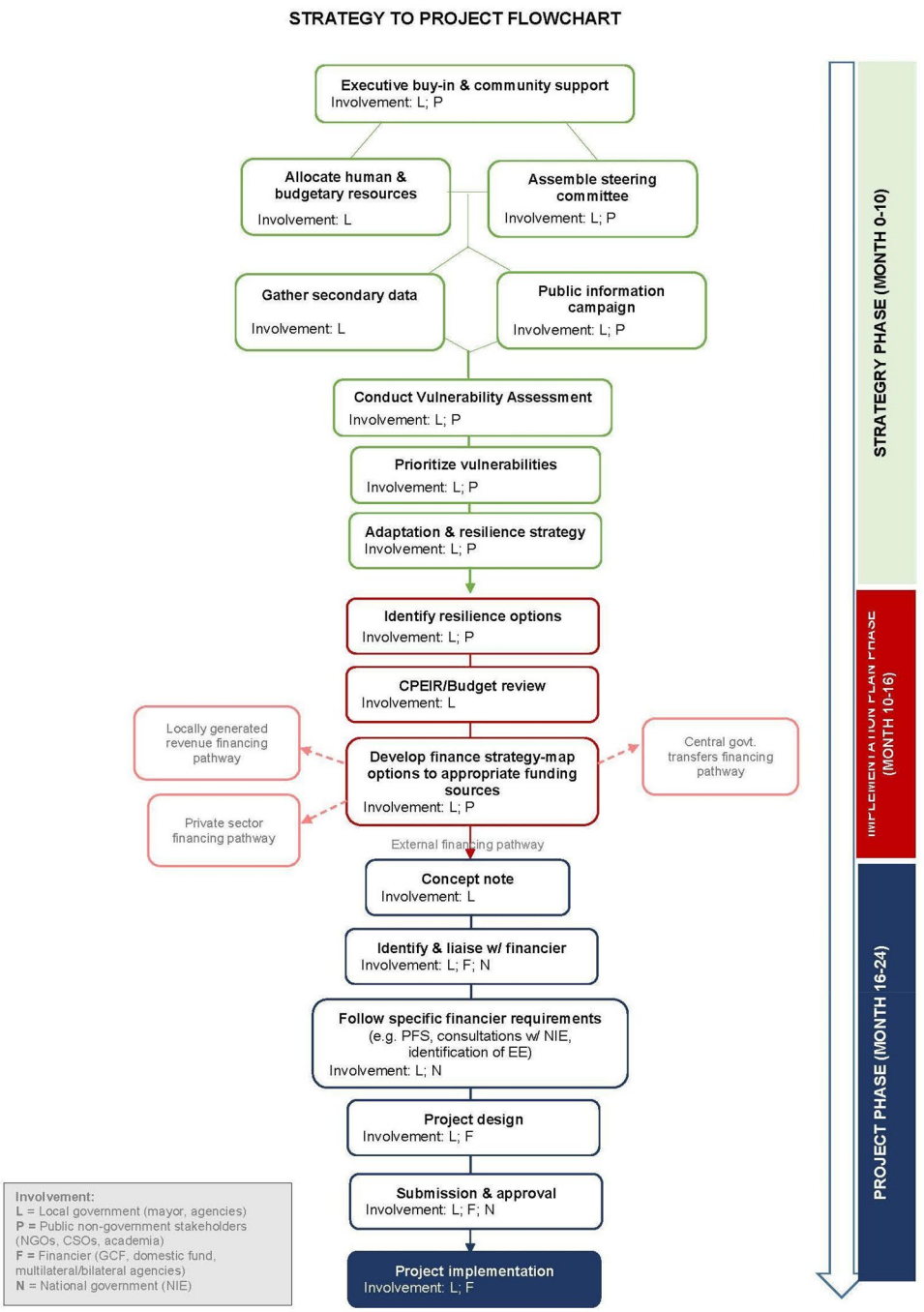

Fig. 1 A "goalpost to goalpost" approach for moving from climate adaptation strategies to projects (framework by authors)

city. The aim here is to go beyond everyday services and processes to consider what a city should do for its inhabitants and surrounding region. We also purposefully convened diverse multi-stakeholder perspectives to ensure broad-based participation and priorities for examining and addressing vulnerability. For example, one participant group decided that an ideal city should provide social and economic growth opportunities for the people that live there. Participants are then asked to draw linkages between the essential functions and the purposes. The objective is to show that city functioning is greater than the sum of city departments and realizing the "purpose" requires integrated programs which engage a wide range of stakeholders across sectors, agencies, and formal and informal institutions. We found this approach begins to demystify the systems concept and enables participants to work together to develop their own definition of the city as a system.

In terms of the practicalities of developing strategies and projects, the introductory session of the course covers basic elements including the mission/vision, statement

of principles, key stakeholders, and baseline conditions in a community. We found that the exercises are effective in building a shared understanding of purpose among stakeholders, which is a critical foundational step for developing an effective strategy/policy document and framework. Once participants grasped the importance of embedding adaptation and disaster risk reduction efforts within a broader vision for the city, we could begin to focus on figuring out the specific nature of the vulnerabilities posed by climate change.

3.2 Identifying climate change challenges for local governments (step 2)

3.2.1 Physical processes and sources of information

It has been shown elsewhere that a localized understanding of climate change is a critical ingredient in effective adaptation (Burch et al. 2013; Measham et al. 2011). In our introductory module, we provide a generalized overview of global warming and climate change. However, we recognize that it is impossible to transfer a comprehensive understanding of the physical processes of climate change in a limited timeframe. We also recognize that many, if not most, participants will bring some knowledge of climate change to the table. Therefore, our focus was on identifying sources of data and information which can be used first for creating a coherent adaptation strategy, and second for informing project design. Key points here are understanding first how to access data and information, and second, how to apply it.

This approach moves from global sources of information, including the Intergovernmental Panel on Climate Change's (IPCC) periodic reports and other global scale sources, including the US National Oceanic and Atmospheric Administration (NOAA) and the UK's Met Office to national level sources of information. In all iterations of the course this material was customized for the country of implementation. We developed material specifically for Indonesia, the Philippines, Bangladesh, India, Nepal, and Vietnam. For example, we utilized Indonesia's RAN-API[2] strategy alongside other national-level agencies and institutions responsible for managing data and information. Then we proceeded to subnational sources of information, including provincial and regional adaptation strategies and reports as well as research conducted at regional universities, and reports published by non-governmental agencies. Participants then develop a "threat profile" for their cities, which is essentially a list of physical stressors that currently or potentially affect the city, along with a description of historical disasters and how these events were experienced by local people. These physical stressors are then mapped to the essential city functions and purposes developed earlier as participants identify the city systems that have been or are likely to be affected, either directly or indirectly, by the identified physical processes.

In terms of strategy and project development, this material enables participants to later craft a coherent description of climate change physical processes which is an integral part of both local adaptation strategies as well as project proposals for adaptation projects. Moreover, participants develop an understanding of how to incorporate data and information management into urban planning. This paves the way for crafting a locally specific "story" of climate change that encourages government support as well as stakeholder interest and involvement in the process of adaptation and disaster risk reduction.

3.2.2 Localized impacts and crafting the message

Through collaborative course development and delivery, we then innovated ways to define the overall problem by involving course participants in creating and disseminating a "localized" climate change message. Developing this localized message involves fostering an understanding of city-specific threats and impacts. We understand the impacts of climate change to be a function not only of physical processes, but also dynamic social, economic, and political characteristics working at imbricated scales, from global to local (Lioubimtseva 2015). This is an important element in motivating action at the local level for several reasons. Numerous analyses and case studies have described a wide range of obstacles to action at the municipal level. These obstacles include crowded policy agendas (Sharma and Tomar 2010), short-term political horizons that elapse before the benefits of adaptation can be realized (Vink et al. 2013), a lack of policy relevant decision support information related to climate change (Measham et al. 2011), a lack of established best practices, and a lack of clear legal mandate to address climate change. For example, we quickly learned of obstacles to climate adaptation planning in our trainings in Indonesia, whereby city officials described a situation in which they were afraid to create line items for adaptation actions in the municipal/regional budget because they lacked the statutory authority to do so. Overcoming the resulting administrative inertia thus requires individual leadership, as case studies from all over the world have indicated (Measham et al. 2011; Roberts 2008).

In response to these practical challenges, we spent considerable effort on *framing* the issue of climate change in the local context (Burch et al. 2013). The first step here is to consider development challenges currently confronting their countries, regions, and municipalities. We sought to

[2] *Rencana Aksi Nasional Adaptasi Perubahan Iklim*, or "National Climate Change Action Plan".

address this issue through an exercise whereby participants developed a "state of the city" statement. This statement would be based upon the city vision developed earlier in the course. Participant groups then worked to analyze how previously identified physical processes interact with social, economic, and political processes, revealing a clearer set of potential impacts. Once this is completed the groups engage in a role play activity that in Indonesia we called "*meyakinkan bupati,*"[3] or "convincing the mayor." During this activity, participants in each group elect a mayor or regional executive and the remaining participants are assigned roles as heads of local agencies (e.g., transportation, water utility, public works). Each agency head is then tasked with making a brief presentation to the mayor about the importance of climate change and why it should be a local priority. Following this, all groups are reconvened, and a facilitator plays the role of the provincial governor who has been granted discretionary funds by the national government to award the municipality or region with the strongest adaptation case. We found that participants particularly enjoyed this activity, and that it unlocks a high level of creativity and enthusiasm which carries over throughout the rest of the course. More practically, the activity helps convey two related messages. The first is that in order to find space in a crowded local policy agenda, climate change must be "localized." In other words, its local relevance must be compellingly demonstrated to decision makers and other stakeholders. The second is that executive leadership is a critical element for meaningful adaptation endeavors.

From the perspective of policy development and project design, this section of the course enables participants to develop context statements describing existing development challenges as well as the current and potential impacts of climate change, which serves several important functions. From a strategy perspective, these exercises enable participants to identify points of entry for adaptation to be mainstreamed into existing institutional and policy frameworks (e.g., spatial plans and development plans). This has been identified as a major challenge in responding to climate impacts (Ziervogel et al. 2016). In terms of project design, it encourages participants to begin thinking about potential adaptation strategies in relation to existing development projects. Context statements are also a key part of successful project proposal documents.

3.3 Understanding the legal and institutional framework (step 3)

After establishing the local relevance of climate change in previous steps of the course, the next step is developing a workable roadmap to identify ways to connect the climate adaptation strategy to the existing legal and institutional framework (Sharma and Tomar 2010). A critical element in making the curriculum relevant to local decision makers and other stakeholders is to ensure that the material is presented in accordance with political and administrative mandates that exist at various levels of government. To this end, we worked with local university partners and NGOs to deliver material specific to the municipality. This means providing an overview of existing institutions, laws and directives related to disaster risk reduction and climate change mitigation and adaptation. After this overview, participants work together to develop institutional maps on the roles and responsibilities of various government agencies directly or indirectly related to climate change and disaster risk reduction.

This approach has several benefits. First, it makes the course immediately relevant to government officials, as it harmonizes the material and activities with tasks for which they are already responsible. We found that this is one of the most interesting aspects of the course for many participants, since in many cases guidance for understanding and implementing central government directives is lacking. Hence, it increases the likelihood that the workshop will result in action items for participants. Second, it enables participants to identify pathways for collaboration among agencies, which can lead to improved coordination and communication. From a strategic standpoint, this helps participants identify agencies that could be part of a steering committee to direct the creation of a municipal adaptation strategy. From a project design perspective, participants can begin thinking of multi-sectoral interventions and implementation arrangements to contribute to effective implementation. Third, it contributes to overall objectives of mainstreaming adaptation efforts into existing strategies, policies, and everyday aspects of governance. Building on existing institutional frameworks increases the probability that chosen adaptation strategies will lead to implementation.

3.4 Understanding and assessing vulnerability (step 4)

Assessing vulnerability is a central aspect of climate change adaptation. Vulnerability assessments generally form the core of climate change adaptation strategies and many countries in Asia and the Pacific have mandated some form of vulnerability assessment at the subnational level. Vulnerability assessments are also relevant to project design, as donor organizations such as the ADB now require climate vulnerability screenings in the feasibility stage of *all* projects. There are dozens of different methodologies for conducting vulnerability assessments, but not all of them are appropriate for all circumstances. In general, many techniques incorporate risk analysis and require a high level of expertise as

[3] This title was chosen because the activity was developed during a brainstorming session while preparing for a workshop in Indonesia.

well as downscaled climate models. While useful in some circumstances, these "top down" methodologies often do not consider the nuances of vulnerability among local populations or the technical skills of those conducting vulnerability assessments (Lindley et al. 2006; Lioubimtseva 2015). This can lead to a technical-rational approach to adaptation that de-emphasizes the role of socio-economic and political processes in shaping the analysis of impacts of climate change (Cannon and Muller-Mahn 2010). In general, these methodologies have provided a great deal of information about biophysical changes, but less is known regarding impacts of increased climate variability on livelihoods (McCubbin et al. 2015). From a practical perspective, the vast majority of cities we worked with have neither the data nor the technical expertise to conduct rigorous risk assessments. Participants indicated that this lack of capacity contributes to administrative inertia at the municipal level. Moreover, failure to address the livelihood connection and nuances of vulnerability makes it difficult to assess which adaptation options are realistic (McCubbin et al. 2015).

To address these issues, the UCCAR course was designed to develop skills in conducting "bottom-up" community-based vulnerability assessments based on the commonly used exposure-sensitivity-adaptive capacity conceptualization of vulnerability (Lioubimtseva 2015; McCubbin et al. 2015). This has several advantages. First, community level vulnerability assessments enable municipal governments to leverage existing knowledge and expertise to identify and prioritize the most urgent areas for adaptation action. A "bottom-up" vulnerability assessment can be conducted with existing resources while local level governments wait for technical assistance and guidance to conduct more complex risk assessments on physical processes. At the same time, bottom-up assessments of community vulnerability are important complements to top-down risk assessments. Bottom-up assessments offer a second advantage: community level vulnerability assessments allow local governments to take immediate action to develop a climate change adaptation strategy which can serve as a foundation for future research and analyses, even before the capacity to conduct mandated top-down analyses has been put in place. Third, community vulnerability assessments, when conducted with broad stakeholder engagement, can reveal micro-political and economic drivers of vulnerability, such as local power dynamics related to infrastructure expenditures, as well as community socio-cultural dynamics that might affect the effectiveness of adaptation measures (Buggy and McNamara 2016; Pham, this issue). Indeed, some authors assert that these political dynamics are the most important factors shaping adaptation processes, since these processes reproduce vulnerability over time (Eriksen et al. 2015), but top-down methodologies do not typically incorporate this type of analysis. The identification of such complexity enables government and non-government stakeholders to design interventions that advance adaptation while producing broader development co-benefits.

After several iterations of the course, we decided that instead of discussing vulnerability assessments, the course would be much strengthened if we could actually model a community-level vulnerability assessment. In cooperation with local implementation partners, we developed a fieldwork component to demonstrate aspects of actual vulnerability assessments. The design of our methodology started with the general criteria offered in Schroter, et al. (2005); namely that vulnerability assessments should (1) be cross-disciplinary and involve stakeholders; (2) should be place-based, attentive to relationships between scales; (3) should examine interacting drivers of change, including climate and socio-economic elements; (4) should examine differential adaptive capacity; and (5) should be prospective and historical.

The fieldwork enables participants to see the practical implications of mapping exposure, identifying "sensitive" people, places and things, as well as the opportunity to interview local residents about manifestations of autonomous and collective adaptive capacity. The fieldwork component takes at least half a day [or longer depending, in part, on the distance of the field site from the training venue], and requires some advance work, which is conducted by the local implementing partner. This advanced work consists of selecting sites for fieldwork, gathering supporting information (e.g., spatial plans, statistical information, etc.), creating large format maps of the area, and making arrangements with local officials and community leaders to facilitate the fieldwork. During the vulnerability assessment, participants conduct a short transect walk. Then, participants conduct semi-structured interviews with key informants in the community. The fieldwork component responds to a general need to increase understanding of community dynamics in the planning and implementation of adaptation projects (Buggy and McNamara 2016).

When implementing the training with the fieldwork component, the discussion of vulnerability is converted into a "workshop" format in which the participant groups are guided through the process of analyzing information about the geographic location as a mini-vulnerability assessment exercise. We also place emphasis on developing indicators or proxies for sensitivity and adaptive capacity. Such fieldwork exercises helped participants understand the practicalities of a vulnerability assessment. The intention is that they will be able to replicate the process and later scale up the assessment to a larger geographic area.

Once the physical processes that affect community (e.g., flooding) have been identified, the next task is to identify the primary and secondary causes of the impacts. During the analysis phase, we model and then practice the development

Fig. 2 Conducting problem/objectives tree analysis in Bandung, Indonesia (photo by Micah Fisher August 10, 2016)

of a "problem tree" and subsequently an "objectives tree." This exercise helps to illustrate a number of important points. First, participants discuss how to define a focal problem within the community. Our statement of the problem aims at understanding climate change impacts from the perspective of catalyzing future interventions. We found that one of the common obstacles in developing subsequent project proposals with cities is the identification of the problem. For example, in many instances participant groups first identify the problem as sea level rise, or flooding. However, these are chronic physical processes that in most cases cannot be addressed through a project or any other intervention. Rather, the *impacts* of these processes are what should be addressed in a resilience planning initiative. Thus, sea level rise becomes something along the lines of "economic losses due to sea level rise." Second, participants discuss the difference between direct and indirect impacts. There is often a great deal of debate within the participant groups as to which impacts are direct, which are indirect, and the chains of causality between them. We found that in all cases, participants spend a significant amount of time debating and revising their problem trees. This illustrates the importance of developing a common understanding of the problem at the very earliest stages of strategy development and project design, as well as the importance of involving a wide range of relevant stakeholders. After completion of the problem tree, participants move on to develop an objectives tree, which is the first step in developing a list of interventions that might alleviate the focal problem (Fig. 2).

From a practical perspective, the problem tree-objective tree is an extremely valuable tool in both the strategy development and project design phases. In terms of strategy development, it aids in identifying the boundaries of the issues to be addressed and is a useful mechanism for building consensus as it represents a "living document" that can be modified over time. From the perspective of project development, the objectives tree can be easily transformed into the backbone of a logical framework ("logframe") for a project proposal (Fig. 3).

3.5 Prioritizing vulnerabilities (step 5)

Vulnerability assessments generally yield a wealth of information about challenges facing communities, all of which cannot be immediately addressed. Thus, an important part of developing adaptation strategies is to identify the most urgent needs. In this part of the course, we provide an overview of several tools that can be used for the prioritization of vulnerabilities or of project options. Moreover, participants work together to develop a timeline for interventions, including urgent adaptation needs and longer-term objectives. Urgent adaptation needs generally include existing vulnerabilities. Long term objectives generally refer to "transformative change." In other words, these are alterations to socio-economic systems and settlement patterns that will be required to adapt to the longer time horizon impacts of climate change. Tools for evaluating options include simple voting mechanisms as well as multi-criteria

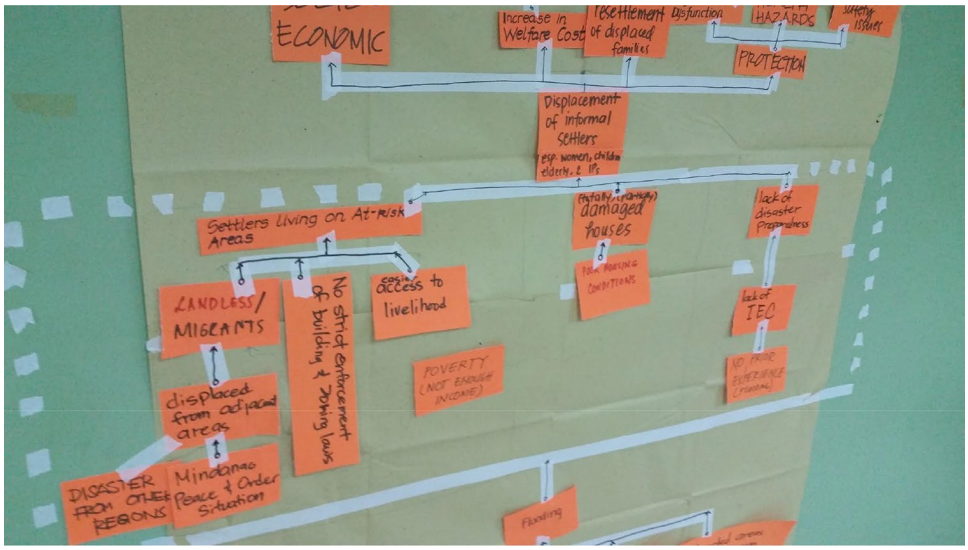

Fig. 3 Problem tree analyzing displacement due to flooding in the Philippines (Photo by Keith Bettinger, 2016)

analysis, cost–benefit analysis, cost-effectiveness analysis, scorecards, and others. Evaluation of options can be done in facilitated meetings of community groups, by a group of experts representing multiple agencies or perspectives. The choice of evaluative tools depends on the group, time and available resources for evaluation, and the costs of making a decision that might lead to maladaptation.

In practical terms, this discussion of prioritization is the first step in identifying the appropriate policy tools and financing mechanisms for each potential project and intervention which will eventually become part of an adaptation portfolio. Participants can begin identifying steps to be taken using locally available resources, and which agencies, organizations, and institutions are best suited to carry out each task. In terms of "transformative change," this provides an opportunity to discuss how planning can help to create incentives over the long term to increase community resilience.

3.6 Developing an adaptation portfolio (step 6)

After a thorough analysis of climate change vulnerabilities and analysis of the nature and causes of specific climate impacts, the next step is to consider different approaches to addressing the identified vulnerabilities. The vulnerability assessment will have identified areas likely to be exposed to increased risk of impacts such as flooding, erosion, or others. The assessment may also reveal flooding risks to critical facilities, such as water treatment plants or electrical generation facilities and to particularly vulnerable population groups such as low-income populations living in temporary shelters located in low-lying flood-prone areas.

One approach to developing climate adaptation options is to focus on policies and projects designed to address the short-term impacts of vulnerable people, places, or facilities. In the case of impacts of flooding, such projects might include building or strengthening of dikes or berms in specific locations, creating increased municipal drainage capacity, increased use of flood-proofing technologies for specific buildings, electrical transmission lines and critical facilities, re-location of some key facilities and increased enforcement of land use regulations governing building in flood prone areas.

An adaptation emphasis on specific place-based projects can deflect attention from existing systemic weaknesses or institutional failures (ISET 2013). This module recognizes the relevance of projects but emphasizes building the holistic resilience of urban systems. Urban systems include infrastructure systems such as water, waste disposal, energy and food distribution networks, social services, and livelihood activities. A key assumption of the urban systems emphasis is that some climate change impacts are likely to ripple through interlinked urban networks causing secondary and tertiary impacts (Moench et al. 2011). Effective adaptation initiatives need to be based on an analysis of the components and functioning linkages of the relevant systems and the institutions and agents that manage the system.

Because of its familiarity to most course participants, urban drainage is used as one of the examples of potential system fragility and systems thinking. In many cities of the region, the lack of drainage capacity in waste-filled drainage canals contributes to the level and severity of local flooding and possible increases in gastrointestinal diseases. Asked to suggest possible adaptation solutions, course participants are likely to suggest either community-based canal cleaning programs or enhanced capacity for local government agencies responsible for the canal cleaning. Encouraged to think more broadly about how to ameliorate drainage-related flooding, they usually suggest understanding the patterns of disposal of wastes in canals, waste disposal alternatives for

the community, and ways to improve those options, staff capacity in public institutions for canal management and the quality and frequency of existing management efforts, community education programs focusing on "proper" solid waste disposal, strategies for changing household incentives for waste disposal, adequacy of existing community drainage infrastructure in light of increased severity of storms, the adequacy of household human waste disposal facilities and other strategies for reducing exposure to flooding and flood-related impacts. This helps make the connection to urban systems.

The module thereafter emphasizes building the resilience of urban systems. Resilience is summarized as: "… the ability of people, organizations, or systems to prepare for, respond, recover from, and thrive in the face of hazards. The goal is to ensure the continuity and advancement of economic prosperity, business success, environmental quality and human well-being despite external threats" (Siemens 2013, p.5). The central idea behind resilience is that both system infrastructure and management procedures are vulnerable to a particular range of risks that require specific solutions to withstand future shocks and stresses. In reflecting on how resilience might apply to an urban drainage system [or other urban system], course participants are asked to generate adaptation options that would increase robustness, redundancy, or other attributes of resilient systems.

3.7 Understanding the financial landscape (step 7)

The last portion of the course addresses one of the primary concerns of key urban stakeholders in identifying and accessing financing for adaptation projects. This addresses perspectives among local decision makers or local NGOs seeking out ways to make the case for funding climate resilience initiatives. The general material presented in this section of the course has been greatly refined over the course of two years, and in each setting locally specific material is included. In the original version of the course, we provided a general overview of global funds (e.g., Green Climate Fund, Adaptation Fund), financiers (e.g., Asian Development Bank; World Bank), and supporting bi- and multi-lateral agencies (e.g., UNDP; USAID; GIZ). However, we quickly learned that in most instances, municipal level governments do not have easy access to any of these resources. Thus, in order to make the content more relevant, we developed and included material on useful tools that can be utilized by municipal governments, including the Climate Public Expenditure and Institutional Review (CPEIR) procedures adapted from the World Bank by UNDP. We also include examples of how to involve the private sector in adaptation planning and implementation. Lastly, we provide information about domestic sources of financing and examples of projects that have been funded and delivered by in-country experts, where possible.

4 Discussion

This paper draws from over 40 course deliveries with cities and regencies in twelve countries. Longer-term engagement also took place with Indonesian cities that aimed to use the course as a catalyst for targeted mentoring and climate adaptation planning initiatives. Taken together, a set of iterative lessons learned were derived across the many planning sessions, delivery, and evaluations of the engagement. These were developed alongside course participants and translated into continual improvements in course design and delivery. More broadly, these lessons respond to challenges identified in the literature about climate adaptation and resilience. For example, we identified clear strategies to the persistent challenges of downscaling climate models, making them relevant, involving key decision makers, and identifying climate change as part of existing vulnerabilities. Meanwhile, we offer some unique insights into working collaboratively across not only stakeholder groups in particular geographies and landscapes, while also gleaning consistencies across national institutional contexts.

To address the localized challenges of addressing climate impacts, establishing strong collaboration with an experienced local partner helps to identify targeted groups of multi-stakeholder participants to convene. This also assists with overall course administration and delivery, while offering key inflection points of presenting materials to decision makers. For example, an Indonesian NGO partner for one course helped cultivate the support of local officials in the training and encouraged participants to attend who are likely to use the training in their professional work. In another course iteration, vulnerability assessment exercises and fieldwork findings were directly presented to elected officials to spotlight local climate vulnerabilities. Working collaboratively to develop a locally relevant climate adaptation course not only builds trust over the process, but also offers capacity building opportunities, innovation, relevance, and ownership. Local partners have expert knowledge of local planning and budgeting processes and can be strategic at convening the venues for continued advocacy and attention around an issue. University partners at another site provided unique facilitation and translation of modules into local languages, and were empowered to make the materials relevant for local contexts. More practically in terms of course administration, local partners require adequate financial support for refreshments, meals, handouts, materials for group activities, transport for site visits, course completion certificates and other services relevant to the training.

Overall stakeholder representation is key in this respect. In our original course design, we developed a substantial amount of case material related to urban flooding in a simulated 'typical' Asian coastal city. The purpose was to provide course participants with an example that would allow them to apply the skills associated with assessing exposure, sensitivity, and vulnerability. We quickly found that course participants wanted to work with climate impacts specific to the communities in which they worked. No matter how rich in detail, generic case studies of climate change impacts in coastal cities are not as engaging as cases based on the conditions in cities in which courses are delivered, especially when participants feel like they are working toward navigating the complexities of their work. Effective "localizing" of a course can take several forms. One is to include a co-creative process with local partners for identifying and mapping key local conditions either in a workshop prior to the training or integrated into the training itself. The workshop output is a city profile based on key urban conditions such as population distribution and density, socio-economic conditions including poverty, local public services delivery patterns, and key infrastructure. This information is essential in constructing realistic climate change impact vulnerability assessments. For a regional course in which participants come from different cities, they can be asked to prepare a city profile prior to traveling to the workshop site. In some situations, asking participants to bring local plans to examine as part of the training process.

In each training, opportunities to visit specific facilities or communities affected by climate impacts or hear presentations by particular local experts were extremely beneficial in translating broader concepts for local relevance. However, such field components also compete for time with designed course activities. In working with local partners on course design, collaborating closely helps to determine what course material has highest priority, particularly if course presentation time is reduced in favor of other learning opportunities. This is especially important for maintaining adequate voice for often under-represented stakeholders. The educational level or professional experience of participants may also require some adjustment in course material. Course "tailoring" may involve dropping some material, shortening some presentations, and reducing time spent on some group exercises.

Small group exercises were designed to provide practice applying the concepts and skills provided in presentations proved to be critical in ensuring that the content material is clearly communicated and understood. Local issues can be the basis of all the small group exercises used throughout the course. Effective small group exercises require careful de-briefing. Having the group report back is a useful component, but effective learning requires some critical reflection. Encouraging group participants to assess the strengths and weaknesses in each other's work helps keep everyone engaged in the learning process. Facilitators can supplement these comments with general observations and evaluative assessments relevant to all participants but must be careful to consider questions of representation.

In the most recent iterations of course trainings, local partners were able to make arrangements for course participants to conduct vulnerability assessments. This highlights how pre-course assessments can go a long way in improving course relevance and meeting targeted learning objectives around climate adaptation and resilience planning. In these instances, local partners identified specific communities likely to be subject to the most severe climate impacts and made arrangements with local officials and community residents to participate in vulnerability assessments. Course participants met with local officials to hear their views on the types of disaster risks their community faces and walked around the community to assess community exposure and sensitivity of specific facilities and households. They interviewed residents about their perceptions of risk, the frequency and severity of local flooding and other problems, the types of measures they take to reduce their vulnerability and their perceptions of actions they hoped government agencies and others would take. Each small group prepared a vulnerability assessment and used the information to construct a "problem tree" and an "objective tree." This type of hands-on experience enhanced their understanding of some community conditions and the challenges of making communities less vulnerable. In one instance at Diponegoro University, faculty and students developed an offshoot research ethics initiative to incorporate household interviews as a learning process in engaging with vulnerable communities. Taken together, broader concepts of vulnerability were wedded with local interests and strategic multi-stakeholder priorities to guide the process.

5 Conclusions

The Urban Climate Change Adaptation and Resilience course was developed as a way to increase awareness among municipal governments and other key stakeholders in the Asia–Pacific. The course and its iterative development and delivery alongside local city stakeholders offers insight on ways to convene, collaborate, and catalyze urban resilience. The course has been translated into several languages and adopted by several partner institutions in South and Southeast Asia and represents an evolving platform that is updated as new information becomes

available around emerging best practices in operationalizing resilience at the municipal level.

Across the 12 countries, working with multi-stakeholder representation from over 40 municipalities, our team of facilitators, practitioners, and local project proponents set out to examine the experience of convening urban climate change adaptation and urban resilience initiatives. We strove to establish local collaborations through a tailored training course that could translate global concepts on climate change vulnerability, downscaling models for local relevance, and learn about different actions municipal stakeholders could do to better understand and respond to a growing problem. We did this through a learning environment centered around co-creating vulnerability assessments and facilitating approaches for operationalizing policy and project initiatives. Reflections highlight theoretical and practical advancements about addressing key barriers to climate adaptation planning and operationalizing outcomes. We identified creative ways to convene multi-stakeholder groups to view cities as systems and engage in dialogue around a collective visioning process. We did this both through technical means but focused on bottom up principles of crafting planning priorities and interventions. Forming multi-stakeholder teams to conduct fieldwork together in a learning environment allowed participants to view ways to initiate and expand climate change adaptation actions, and provided pathways for convening and resourcing policies and projects. Over time, we learned to develop creative tools for problem identification, while also situating them within national and local regulatory contexts, and charting out pathways to address challenges by integrating solutions in formal and informal planning processes. We developed responsive channels for maximizing resources locally and from elsewhere. Future initiatives to localize climate science and build adaptation interventions will serve to benefit significantly by rooting initiatives within multi-stakeholder representation from across local institutions with long-term interests that convene around an action learning process.

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