Working across scales: Learning from seven years of climate compatible development in Asia

By John Colvin and Christina McDonagh

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What is climate compatible development?

Climate compatible development is defined as "a 'development first' approach that minimises the harm caused by climate impacts while maximising the many human development opportunities presented by a low-emissions, more resilient, future".[1] In other words, development, climate adaptation and climate mitigation should go hand in hand, and one should not undermine the others.

About the authors

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Executive summary

The adoption of the Sendai Framework for Disaster Risk Reduction, the Addis Ababa Action Agenda, the United Nations Sustainable Development Goals and the Paris Climate Change Agreement, all in 2015, highlights the strength of international commitment behind climate compatible development. Given the immense scale of the opportunity, and the challenges globally in responding to this, we argue in this report for the value of stimulating climate compatible development initiatives at multiple levels of governance, from the local to the national, as well as the global, and of designing these initiatives in ways that maximise the synergies of effective coordination between the levels.

Seven years of work by CDKN in India, Indonesia, Nepal and Pakistan offer a wealth of experience to build on. This report looks across 10 CDKN initiatives that worked at multiple scales, some focusing initially on local-level piloting, and then scaling up and out, others focusing from the outset on innovation at multiple levels of governance.[2] As a way to stimulate and share learning with the reader, we treat these 10 initiatives as a set of 'design experiments', all of which have benefitted the many and diverse stakeholders involved, but with some of these initiatives leading to more effective multi-level pathways of climate compatible development than others.

We argue that effective design is key to working with scale. The report analyses design through two lenses, making a distinction between pathways for working with scale, and principles for enabling effective pathway development for climate compatible development.

Pathways describe the different strategies adopted for working with scale, and are linked to outcomes. The 10 pathways we review fall into three broad categories:

- Short-term multi-scale pathways that are research-led, and succeed in building awareness, but fall short of embedding new practices.

- Short-term multi-scale pathways that adopt a hybrid action and research approach from the outset, and succeed in embedding new practices at some scales (mainly locally), but not at others.

- Longer-term multi-scale pathways that take an action research-led approach, and succeed in embedding new practices at multiple scales.

Analysis of these pathways suggests the following design **principles** for enabling effective, multi-scale pathways for climate compatible development:

- Get into action early, by encouraging the use of action research approaches.

- Adopt a flexible and adaptive management approach to project and pathway development, consistent with an action research framing.

- Extend initial short-term project investments into longer-term pathways, but only in cases where innovation is taking hold in practice as well as in understanding.

- Adopt flexible points of entry, responding to opportunities as well as more carefully planned approaches.

- Draw on a rich and flexible toolkit of knowledge brokering and knowledge networking practices, with particular attention to 'knowledge bridging' between sectors and between scales.

CDKN Asia's seven-year experiment in design highlights the value of initial investments in climate compatible development pathways that are relatively 'light touch' (maximum two years), action-led, reflexive and engage actors at multiple levels of governance. By building learning loops and adaptive decision points into such pathways, those experiments that yield promising results during the initial period can then be extended, both to further embed initial successes, and to explore these in other contexts either through processes of scaling out and up, or through expanding multi-level innovation processes already in train.

In addition, CDKN's experience highlights the highly contextualised nature of every climate compatible development pathway, and the need therefore to design for multi-scale pathways by drawing on the principles discussed above, while also taking particular account of cultural, economic and political contexts in selecting appropriate knowledge brokering practices.

Introduction

The year 2015 saw the adoption of four ground-breaking global policy agreements – the Sendai Framework for Disaster Risk Reduction,[3] the Addis Ababa Action Agenda on financing for development,[4] the United Nations (UN) Sustainable Development Goals (SDGs)[5] and the Paris Climate Change Agreement[6] – each interlinked with the others in numerous ways. Executive Secretary of the UN Framework Convention on Climate Change Patricia Espinosa reminds us that, "the ultimate objectives of the Paris Climate Change Agreement and the SDGs will be achieved only if they are fully recognised as one encompassing agenda",[7] while UN special representative of the secretary-general for disaster risk reduction Robert Glasser highlights, "the need to break down the silos that exist around action on disaster risk and climate risk and … [to build] greater coherence across the 2030 Agenda for Sustainable Development".[8]

Implementing these agreements and their interlinkages is an ambitious task, but one that can be achieved provided that governments, non-governmental organisations (NGOs), businesses and donors can learn from the wealth of experience already available, and apply this in practice. To support this process of learning, this report reflects on seven years of CDKN work in India, Indonesia, Nepal and Pakistan, providing tangible examples of opportunities seized, challenges encountered and strategies implemented. Bangladesh, unfortunately, had to be excluded from this report because of the strong unitary nature of its polity – without any provinces or states – making it difficult to identify any subnational work of significance carried out by CDKN. The detailed methodology for this study is given in the annex.

With a focus on 'climate compatible development' – that is, mitigating climate change and managing its impacts, while achieving human development – CDKN's approach is highly relevant in its ambition to work at the interface between climate change mitigation, adaptation and sustainable development, while also embracing the interface with disaster risk reduction.

Over the past seven years, CDKN has broadly prioritised four areas of climate compatible development work: climate negotiations, climate finance, disaster risk management, and policy and practice. We address themes that cut across these, in this report: how to work with the challenges and opportunities of scale, and of linking learning and action at more than one scale, from local, city and district to provincial, national and regional levels. Drawing out learning from 10 CDKN initiatives, the report explores two complementary questions:

- How can programmes be designed to deliver climate compatible development benefits at scale, including the scaling of climate compatible development approaches initially piloted at local levels?

- What design principles underpin effective, multi-scale implementation of climate compatible development?

Scale: A critical issue in climate compatible development

Why scale matters in climate compatible development

There are several reasons why scale[9] is a critical issue in climate compatible development.[10] Firstly, change and innovation for climate compatible development can be initiated at many different levels, from global to national to local. Given the challenges inherent in climate compatible development as a process of change, it makes sense to invest in change initiatives at a number of different levels.

Secondly, these levels are interconnected (Figure 1). For example, to be effective, national climate policies and plans need local implementation. This is true for both low-carbon and climate-resilient development, but particularly for the latter, with vulnerability sensitive to local social, economic and ecological conditions. Often, local implementation happens through a multi-tiered structure of provincial, city and district governments, and a combination of public and private actors – a process known as multi-level governance. Actors at provincial, city, district and community levels are therefore key players in efforts to meet national goals.

Furthermore, there are at least four processes that link national to local levels, each of which requires effective coordination:[11]

- Formal and informal institutions produced at one level influence processes at another, with the flow of authority being top-down, but with many processes of influence taking place bottom-up.

- Actors from one level (e.g. national) participate in decision processes at another (e.g. provincial or local). In this way, actors can become actively involved in the production of policies, rules and programmes whose influence they might be subject to.

- Knowledge produced at one level influences processes at another.

- Finance required at one level is produced at another.

Figure 1. Linking local to national and global actors and responsibilities[12]
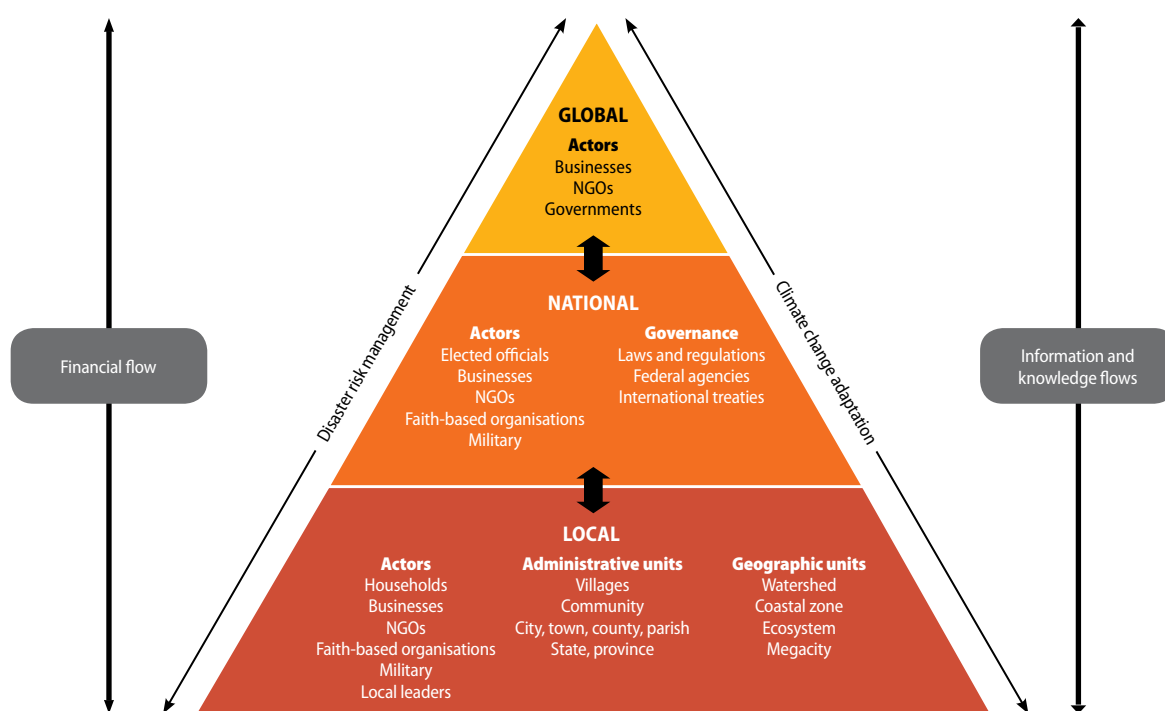
Given these two-way flows of authority, engagement, knowledge and finance through systems of multi-level governance, local climate policies and plans may need national support to ensure effective implementation, just as much as national policies rely on local actors. This is particularly the case for low-carbon development initiatives, where financing arrangements, such as for Nationally Appropriate Mitigation Actions (NAMAs), often fall under the responsibility of national government entities.[13] Other financing modalities, such as the Adaptation Fund and the Green Climate Fund, tend to be coordinated either nationally or regionally.

Equally, without effective multi-level coordination and feedback, national and provincial policies and practices can stand in the way of effective local implementation, especially where these require innovative or adaptive solutions, as in the case of climate compatible development. For example, research in Ethiopia, Mozambique and Uganda highlights how inflexible national policies inhibit local innovation and initiative, and the types of flexible and forward-looking decision-making required to build adaptive capacity for climate-resilient development.[14] Similar processes have also been found in Asia.

In spite of these challenges, a wealth of innovation for climate compatible development does develop at the local level, as highlighted in studies of both community-based adaptation[15] and low-carbon development.[16] Progressive local actors can, therefore, play an important role in driving country-wide responses to climate change. By undertaking successful pilot or pathfinding initiatives, these can then be scaled up to help shape policy, and/or scaled out and adapted for use elsewhere, becoming the seeds for potentially transformational change at a far greater scale.[17] In the absence of such scaling, the impact of local innovations remains relatively small in the face of the global climate challenge, where aggressive mitigation action is required to contain the average temperature rise globally, and climate adaptation is required on a much larger scale.[18]

Finally, some would argue that the scale of transformational change required for effective climate compatible development is only possible given extensive experimentation and learning, both locally and at multiple scales.[19] This in turn requires investments that can support such experimentation and enhance feedback and learning loops at and between multiple levels of governance.

Designing for working with scale

Given the importance of scale to effective climate compatible development, what can we learn about project or programme **design** for working with scale? Recognising that good design is key to the effectiveness of programme planning and implementation,[20] here we use the term 'design' to refer to "systematic, creative processes that engage people in exploring problems and opportunities, develop new ideas, and visualise, test and develop new solutions".[21] In considering design, we focus both on early stages of the programme development/design process, often closely associated with theory of change (ToC) (as ToC development involves being explicit about underlying design assumptions and principles), while also considering design as an ongoing and sometimes emergent process, shaped by flexible and adaptive management, which takes place throughout programme implementation and which can never be fully understood except in retrospect.[22]

While principles of designing for scale in many other policy areas have been researched extensively,[23] it is only as programmes and initiatives come to maturity that we can elucidate the effectiveness of multi-scale design practices in the context of climate compatible development. Given that most work on climate compatible development in Asia has been initiated only in the past 10 years, and much of it more recently, insights and learning remain at a premium. CDKN's work in Asia adds to recent work in this area,[24] offering a rich set of insights into designing for and with scale.

Design pathways for working with scale in climate compatible development

Across the 10 initiatives we review, many different approaches to working with scale can be found. Drawing on previous work seeking to analyse different approaches to scaling up good climate adaptation practices,[25] here we make a distinction between **pathways** for working with scale, and **principles** for enabling effective pathway development for climate compatible development.

'Pathways', as discussed in this section, describe the different strategies that were adopted for working with scale, and are linked to outcomes. The 10 pathways we review fall into three broad categories: short-term multi-scale pathways that are research-led and succeed in building awareness, but fall short of embedding new practices; short-term multi-scale pathways that adopt a hybrid action and research approach from the outset, and succeed in embedding new practices at some scales, but not at others; and longer-term multi-scale pathways that take an action research-led approach, and succeed in embedding new practices at multiple scales.

Short-term pathways: Building awareness, but falling short of action

In Indonesia, CDKN funded a pilot, multi-level, research-led initiative to explore the institutional challenges and potential solutions to developing a supported NAMA in the province of West Nusa Tenggara (Box 1). This 14-month project (2013–2014) supported by the national Ministry of Energy and Mineral Resources (ESDM), drew on two provincial-to-local case studies and led to a set of policy recommendations submitted to ESDM to inform a NAMA concept. Despite the quality of the multi-level institutional analysis produced by the research, which initially engaged the interest of ESDM, three years after completion of this study there has been no decision to invest in the NAMA concept, with ESDM's interest shifting away from NAMAs and towards energy conservation. As national policy changes were critical for local-level investment to proceed, the project also led to little change on the ground, revealing the limitations of this relatively brief, research-led approach to low-carbon transition in the context of Indonesia's energy political economy:[26]

> "In my view, the ESDM is less interested in NAMAs compared to energy conservation. I would conclude that the concepts are all excellent, and the technical assistance probably well appreciated; however, to be more effective, there needed to be proper involvement of ESDM as service recipient from the very beginning, and at all stages. Good buy-in is key."[27]

Another example of a research-led approach is demonstrated by the CDKN initiative in Nepal to increase the resilience of irrigation systems (Box 2). Here, two catchments in the western region of the country were selected for in-depth study (two years, 2015–2017). Data was collected on the performance and management of small- and medium-sized irrigation systems, and on noted changes in climate in those areas, as a means to inform future national policy and regulatory decisions within the Ministry of Irrigation, and to provide guidance on future investment. Perhaps even more clearly than in the Indonesian initiative, this research supported the development of new thinking at a national level, but it is too early to see how this will be applied in practice. At national, district and local levels, therefore, there is as yet no evidence of any changes in practice. Of particular interest are the challenges encountered in this study between the quality of local findings and how to bridge from these into an approach to scaling across the whole country:

> "I think it was relatively easy working at an individual scheme level to see what the problems were there and to come up with some recommendations. But generalising and coming up with guidance for the department [of irrigation] is quite tricky. You want to do something small and then scale up quickly – it applies on almost every project, not just this one. And with limited resources, it's particularly difficult.
>
> "I think the way we set about it was to involve the department staff in our team throughout, both at central level and at district level, so that they saw what we were doing on the individual subprojects. I think [that] on a fairly limited scale, they would be able to scale up. Expanding that to completely different parts of the country is more difficult. But at least they could understand how to do it elsewhere. Whether they would do it elsewhere or not is another matter, but at least

Box 1. Indonesia: Developing a NAMA in West Nusa Tenggara

The starting point for this initiative was an international project known as 'Mitigation Momentum' (MM), funded by the governments of the Netherlands and Germany to support the development of NAMA plans in Indonesia, and delivered by the Energy Research Centre of the Netherlands (ECN). The aim of this project, which started in 2012, was to design a set of policy measures that would support the emergence of independent power producers (IPPs), and promote IPP investment in small- and medium-sized electricity generation schemes from renewable energy sources.[28] CDKN supported a component of this research, a subnational pilot in the province of West Nusa Tenggara, to complement a pilot already being undertaken through the MM project in North Sumatra.

These two provinces were already active in developing renewable energy as part of Indonesia's National Action Plan for Greenhouse Gas Emission Reduction, but they were significantly different in economic status and energy systems. North Sumatra had a larger and more widespread power sector that faced the challenge of needing to rapidly expand. In West Nusa Tenggara, the power system was less developed, with a significant portion of the population relying on off-grid generators or having no access to electricity. There was also less experience with IPPs. In West Nusa Tenggara, the focus was therefore on building support for the idea of IPPs and understanding the common challenges between off-grid and on-grid renewable energy projects, i.e. what could support for IPPs potentially offer to off-grid projects?[29]

Through the ECN, the CDKN project undertook interviews at a local level to explore the opportunities and barriers to setting up IPP schemes as perceived by local stakeholders. The research found that the main barriers to initiating schemes were difficulty in accessing finance, a lack of technical capacity and skills, and complicated permit regulations imposed by government. The issues ranged from the acquisition and tenure of land for infrastructure to the length of time and difficult process of obtaining permits, and coordination of different sector policies along with lack of legislative consistency across government tiers. At the end of 18 months of work, the project put forward three proposals for how governments at all levels could assist the uptake of IPPs:

- A clearing house that would provide technical expertise, coordination of activities and seed funding for feasibility studies.

- A mechanism for compensation if the national grid became unstable and was not able to provide a consistent income for investors and producers.

- A selection of financial instruments to improve access to capital and supply partial risk guarantees for financial investors and developers.

In summary, the project helped build understanding and knowledge at provincial and local levels of the role that IPPs could play in generating renewable energy under NAMA instruments. The project report also identified and put forward to ESDM recommendations for specific policy and institutional changes that would facilitate the uptake of IPP mechanisms for generating renewable energy. To date, however, there has been no decision to invest in the NAMA concept.

they could see what the issues were that we were exploring and the way we were coming up with solutions."[30]

Both these initiatives, while developing new awareness among national policy-makers, and no doubt also among provincial, district and more local actors, have yet to demonstrate impact in terms of changes in individual or institutional practices. In the Indonesian case, the probability of impact after three years appears to be much reduced, although further research into unintended impacts may reveal as yet little understood pathways. In the Nepal case, it is too early to comment on potential changes in practice.

We reflect further on these two cases at the end of this section, in light of the eight other cases reviewed. The main question we wish to raise at this point concerns the extent to which more 'traditional', linear, research-led approaches are able to yield significant changes in climate compatible development practice in the context of relatively short-term investments (both were shorter than two years) and in light of the challenges of instituting change across very significant differences of scale, from the national to the local.

Box 2. Increasing the resilience of irrigation systems in Nepal

Changing climate patterns in Nepal are affecting the availability of water for agricultural irrigation. There is increasing demand for water as crop production intensifies, temperatures rise and rainfall patterns change. In some areas, there has been an increase in rainfall at certain times of the year, and an increase in flooding that damages irrigation infrastructure, but the overall picture is one of uncertainty. Building on recommendations from the *Economic impact assessment of climate change of key sectors in Nepal*,[31] the Ministry of Irrigation invited CDKN to undertake a more detailed study to review the impact of climate change on small- and medium-scale irrigation systems.

A project team led by the international supplier Mott MacDonald, working with three local organisations, used a systems approach to investigate the vulnerability of irrigation infrastructure with the aim of developing an improved approach for increased resilience and effectiveness. An initial project literature review and consultations with irrigation managers were undertaken with reconnaissance site surveys in different parts of the country – east, central and west, in the Mountain, Hill and Terai biomes, covering five districts. Two catchments in Nawalparasi and Kapilvastu districts (western region) were then selected for more in-depth study of the performance and management of irrigation systems, and changes in climate in those areas.

This research provided the Department of Irrigation with a framework for building climate resilience into small- and medium-scale irrigation systems, including improving irrigation effectiveness, efficiency and equitability in the face of climate change and climate extremes. The research aimed to provide the ministry with an evidence-based analysis. This was intended to inform recommendations to guide future policy and regulatory decisions in irrigation and related sectors, and to provide guidance on future investment. The research will also inform the new Irrigation Master Plan, which is in preparation.

Short-term pathways: Hybrid approaches

In this second set of cases, we review four initiatives that also involved relatively short-term, multi-scale pathways (all again had a maximum length of two years), but that adopted a hybrid action and research approach from the outset, and succeeded in embedding new practices at some scales but not at others. We review cases from across India, Indonesia, Nepal and Pakistan.

In India, CDKN funded a 21-month initiative to research the design of a franchise model for conversion from diesel to renewable energy in rural areas. This well-designed study took place in two phases (Box 3). During the first phase, three business models were tested in five pilot sites in the states of Bihar and Uttar Pradesh. The first of these models – involving 100% investment by a local enterprise that owns and runs the assets – was the preferred and more effective business model:

> "Piloting was a vital element of this project. Piloting is vital to understanding how the market can be made to work for climate compatible development. Otherwise the private sector doesn't participate in the development of workable climate compatible development solutions."[32]

By using an action research approach in this first pilot phase, those communities that tested the locally led investment model were in a position to implement it by the end of the study.[33] However, finding a way in phase 2 to scale out these findings proved more elusive, as CDKN was unable to negotiate a mechanism for financing outscaling in the time available before the project ended. While it did investigate a mechanism known as 'portfolio guarantees', which cover a proportion of the losses on a package of loans or projects, it was unable to persuade the government to invest in this. While donors such as the United States Agency for International Development (USAID), the World Bank and the United Kingdom (UK) Department for International Development (DFID) expressed an interest in supporting such a mechanism, they were prepared to provide only part of the portfolio (known as a 'second loss guarantee'), which also required government commitment to a matching element of the portfolio (known as the 'first loss guarantee').[34] While developing insights into possible solutions for taking the findings of the pilots to scale, funding restrictions and/or lack of time for a further phase of work prevented agreement of an effective solution for franchising at scale. As a result, CDKN was unable to respond to a significant opportunity when the Government of India announced the National Law on Offgrid Systems in late 2016.

Box 3. India: Engaging the private sector in climate compatible development in Bihar and Uttar Pradesh

As many as 75 million households in rural India are deprived of quality electricity or have none at all, and so there are numerous opportunities for development. This led CDKN to develop a project entitled 'Designing a franchise model for conversion from diesel to renewable energy in rural India', which set out to work with existing local entrepreneurs operating diesel generators and mini-grids.[35]

Given the need for financial innovation at scale, the project researched a franchising approach for conversion of diesel generator (DG) mini-grid operators to decentralised renewable energy (DRE) mini-grid entrepreneurs. This was achieved by: (1) establishing commercially viable pilot projects showcasing conversion, with triple bottom-line impact on the electricity-starved rural population; and (2) crafting evidence to support scaling up by identifying enabling conditions for an aggregator of DG operators or a cluster-level entity to enter the space.

During the pilot phase, the supplier team – which comprised cKinetics and the not-for-profit Technology and Action for Rural Advancement (TARA) – tested three business models across five pilot sites:[36]

1. 100% investment by a local enterprise, which then owns and runs the assets.

2. A mixed model comprising investment by both a local enterprise and a venture capitalist,[37] with shared operational costs. Under this model the local enterprise would then pay off the loan over time.

3. The entire enterprise is run by a venture capitalist; with the local enterprise paid wages.

Model (1) was the preferred and more effective business model, as there was sufficient finance already available among local enterprises; what was previously lacking was knowledge and understanding of this investment option and its multiple benefits:

> "The local enterprises who converted to the DRE mini-grid approach were very proud of what they had done. Providing a digital platform so they could ensure the proper collection of tariffs from end users, plus the option for a load cut-off point if agreements were not honoured, was an important part of the solution developed by cKinetics and TARA."[38]

Following the pilot process, a small, facilitated, business sector learning event was convened in October 2015. The workshop brought together bankers and investors with the project team, and with donors such as USAID, the World Bank and DFID. Government representatives were invited but could not be persuaded to attend.[39] Designed to explore barriers and opportunities to scaling, the workshop highlighted the need among banks and other investors for accurate stories of early market experiments if they are to take the potential for investment in scaling up seriously. Without proper reporting of failures as well as successes in these experiments (due diligence), they will not engage.

> "The workshop was a very significant moment for us. As the government was not willing, we needed to mobilise aid partners to provide first loss guarantee. But aid partners were not sure. They committed to a second loss guarantee but not first loss."[40]

Following the workshop, cKinetics designed and published a risk guarantee framework for DRE financing. Unfortunately, the project was stopped at this stage (early 2016) as there were no further funds available.

The second case in this subsection is from Pakistan. During 2015–2016, CDKN funded an initiative to develop renewable energy solutions for Sialkot city, one of Pakistan's most emblematic industrial hubs (Box 4). A first, eight-month phase, which was designed around the possibility of a NAMA-led investment, illustrates the complexity of assembling a constellation of stakeholders from different sectors and levels of governance (federal, provincial and city), not only to develop understanding of different renewables options that must also deliver energy security, but also to build ownership of a NAMA recommendation at all levels.

While the outcome of this first phase was encouraging when measured against most of these criteria, the federal Ministry of Climate Change (MoCC) was cautious about commitment to this NAMA option.[41] With low take-up of this government-led NAMA option at the federal level, one alternative might have been to develop a private sector NAMA, with the design, support and implementation led entirely by private

sector entities, including Sialkot's small- and medium-sized enterprises (SMEs), their trade unions and the Chamber of Commerce. However, in the second, 10-month phase of this work, other potential investors came to the table. To increase the chances of funding, the project would have to be seen not exclusively as a NAMA. In other words, the project could be funded as a NAMA or on its own merits. This opened the door for funders such as the State Bank of Pakistan and the Asian Development Bank. The decoupling of the project from the NAMA label also broadened the range of possible political sponsors, such as the federal Alternative Energy Development Board (AEDB).

> "This is a very important nuance from the first year to the second year, where we deliberately decided not to label this as a NAMA, because we wanted to increase the likelihood of the actual solar panels being bought, so we said: 'we will develop a project that **could** be financed as a NAMA'. And that opens up the chance to say, you could do it through a NAMA or you could do it through traditional development assistance or with private funding."[42]

In contrast with the Indian DRE mini-grid case, the action research in the Sialkot initiative took place primarily at the national level, with an emerging focus on finding and agreeing a set of national partners

Box 4. Pakistan: Renewable energy solutions in Sialkot city

The province of Punjab has the fastest growing provincial economy in Pakistan. It is also the most industrialised province in the country, contributing close to 58% of the country's overall industrial production, of which the bulk is through SMEs. Since 2007, however, there has been a sharp decline in Punjab's industrial growth, primarily due to the shortage of electricity.[43] In 2014, when the provincial government approached CDKN for assistance, Sialkot was experiencing load shedding of up to six hours a day, with businesses becoming increasingly reliant on diesel generators, thereby increasing greenhouse gas emissions as well as the cost of production.

The project developed by CDKN aimed to assess the viability of renewable energy to meet the needs of the SMEs in Sialkot, to find solutions to energy shortages, and to explore the potential for how a partnership between the federal government, the private sector and the provincial government of Punjab province might work best. With support from the federal MoCC, there was an initial focus on developing a subnational NAMA as a financing mechanism, the first time this had been attempted in Pakistan. Ecofys (Netherlands) was commissioned as lead supplier, working with the Pakistan Industrial Trading Corporation (PITCO) as the in-country supplier.

Ecofys and PITCO analysed Sialkot's industrial energy demand and the availability of renewable energy technologies in Pakistan. During the summer of 2015, over 100 Sialkot industrialists participated in workshops to analyse their energy demands, the distribution among different company sizes and the renewable energy options available, along with associated costs, savings potential and emissions reductions. This first phase of work assessed individual solar generation in the vicinity (i.e. photovoltaic or PV panels on rooftops) to be the best option.

The analysis was developed further during 2016 as a NAMA proposal, to include baseline data, technical analysis and financial analysis. However, during this second phase, the focus of stakeholder interest and engagement shifted significantly. While there was continuity of ownership from Sialkot's industrialists (and the Sialkot Chamber of Commerce) and from the provincial government, at the federal level the MoCC was more cautious about the way forward. As a result, the suppliers worked to bring on board other actors to play a convening and financing role, principally the AEDB and the State Bank of Pakistan, respectively. In early 2017, while a financing solution that works for all parties, including demand (in Sialkot), supply (from technology providers) and finance (domestic and international), has yet to be agreed, there are prospects for a way forward:

> "My understanding is that a private sector or private entrepreneurial type could very well use what we've put forward, to channel money through it, because we have everything: we did the financial models for 15 of these SMEs, and we extrapolated that to all of the SMEs in Sialkot using proxies to fill in the blanks. At the federal level, there is continuing interest from the AEDB. The State Bank of Pakistan is also interested; they know about what we're doing, and they have a fund for renewable energy, for projects between 1 MW and 50 MW, with 6 bn [Pakistani] rupees as a cap for a single project. This fits the Sialkot project well. And while the AEDB doesn't give out the credits directly, it does it through commercial banks. Further, to complement financial resources, the AEDB is willing to provide technical support and awareness-raising."[44]

that together could combine the impetus for demand and supply with an appropriate financing model. While such a partnership has yet to be agreed, this action research process has, at a minimum, progressed the outline shape of such a partnership. By contrast, at the state-to-local level, while significant participatory research was undertaken, this cannot strictly be termed as action research, as no significant changes of practice have yet taken place. However, understanding and ownership of a renewable energy investment based on solar PV have been advanced to a significant extent locally, supported by new relational capital, which is well positioned once investment is agreed. Given that the greatest investment of time and technical analysis took place locally, this was an important element in the design of this project.

While the first two cases in this subsection both focus on renewables, the other two focus on climate-smart agriculture (CSA) and urban climate compatible development. In Nepal, work by CDKN for the Ministry of Science, Technology and Environment (MoSTE) in 2012–2013 had highlighted the potential impacts and economic costs of climate change for three major risk areas – agriculture, hydroelectricity and water-induced disasters – and identified climate compatible development options to address these.[45] Building on these findings, a further two-year initiative (2015–2016) was designed to help the Ministry of Agriculture and Development (MoAD) develop a model of CSA that could be taken to scale. The project took an innovative design approach, focusing on generating insights and learning from three action research pilots, one from each of three agro-ecological regions, and then using these to support MoAD staff in understanding what CSA might mean in practice, and how to implement this at scale (Box 5).

Box 5. Nepal: Climate-smart agriculture

Nepal's agriculture sector, which accounts for around three quarters of employment and one quarter of the country's gross domestic product, is strongly affected by current climate variability, uncertainty and extremes. Many farmers operate at small scales, are already poor and are extremely vulnerable to climate change. The impacts on agriculture are more pronounced among women and smallholders, who have poor access to natural resources and public services, have limited livelihood options, and are highly exposed and sensitive to climatic threats, such as droughts, floods, soil erosion, landslides, pest outbreaks, and heat and cold waves.

Initially, the project worked with MoAD and MoSTE to explore whether the framework of CSA, interlinking food security and climate change, was appropriate. Having agreed with MoAD staff the value of a CSA approach, the project then began to work with local farmers, local service providers and village development committees, using local knowledge and technical input to explore what climate resilience might look like in practice at the local level.

> "One approach might have been to develop scaling-up strategies without piloting. While it is possible to choose climate-smart agriculture technologies from a literature review, we felt that field-based evidence was important – so that we could learn about barriers to adoption. We felt that the learning would be very specific to climate-smart agriculture practices. We also knew that government actions often lack richness – for example, 80% of farmers are never reached by government. So that was another reason for field-based evidence."[46]

Doing the fieldwork was valuable because it demonstrated exactly what action can be implemented with farmers to build their climate resilience. This led to the following main findings:

- CSA interventions should be designed using socially disaggregated vulnerability assessments, which articulate the local context and climate risks.

- Communities are more likely to accept CSA technologies that have multiple benefits and fit well in their integrated system of agriculture.

- Targeting and building the capacity of existing agricultural development institutions facilitates the implementation of CSA programmes.

- CSA has a better chance of success when different stakeholders match and apply leverage to share and obtain each other's resources. These can include the private sector, government extension offices and NGOs.

- Implementation of CSA becomes more effective if technologies are piloted and promoted in a package or portfolio of measures. This yields better results than introducing individual technologies in isolation, and helps to sustain outcomes. In addition, farmers want technologies and practices they stand to gain benefit from quickly.[47]

An important feature of this project is that it was designed to work with both local and national levels of action and responsibility. Here, the main design considerations concerned the relationship between learning within and across the three local pilots, and learning at the national level, including from the pilots:

> "Linking the local pilots to the national level was a daunting task. Our partner [Climate Change, Agriculture and Food Security or CCAFS] had strong modelling and GIS [geographic information system] experience. This helped us to extrapolate the local pilot work to the national scale, using a recommendation domain map. This recommends how scaling can be done – if government scales up these recommendations in this way, then these would be the impacts (e.g. increases in rice production). It was a way to help government think about the benefits."[48]

Despite these challenges, the outcomes of this project were promising. At the local level, the project built specific practical skills and capabilities for farmers, extension workers and planners; for instance, training farmers on zero tillage and other CSA technologies. Enhancement of capabilities also took place nationally, providing policy-makers in the MoAD – and indeed across the seven ministries represented on the project's steering committee – with a better understanding of CSA and how to scale it up, and providing MoSTE with a CSA study, which it is considering using in its National Adaptation Plan. Thus, like the work in Bihar, an action research process led to changes in practices locally, while at a national level the research built new understanding and insight, but this has yet to be implemented.

In the final initiative in this category of blended pathways, CDKN commissioned a two-year project to explore innovative ways to support the city of Kupang in Indonesia to access climate finance for climate compatible development actions. Kupang had neither a plan of action to cope with the impact of climate change nor strategies to reduce greenhouse gas emissions. In addition, the local government had limited ability to generate local revenues or access other resources for climate actions, which otherwise relied on central government transfer of funds. Furthermore, while climate change had been considered in the medium-term provincial development plan (2012–2017), this did not acknowledge the needs of the provincial cities in relation to climate change, giving more attention to land-use issues. For this case, therefore, the challenge of financing climate compatible development was embedded in a complex, vertical governance relationship between national, provincial and district/city-level planning (Box 6).

The Kupang case study was significant in highlighting the multi-level governance issues associated with climate compatible development financing in many Indonesian cities, and the constraints on the effectiveness of climate finance disbursement. The study also highlighted the need for coordination among stakeholders at the local level – which was an emerging feature of the city-level action research process – and that this must also be synchronised with the national level.[52] As in other hybrid cases in this subsection, the project time frame meant that despite the emergence of some on-the-ground solutions that did not require multi-level coordination – specifically in the form of grants provided by the Bank NTT to encourage urban sustainable energy initiatives – there was insufficient time to go beyond the generation of insights and to embed more comprehensive multi-level financing solutions that would benefit Kupang and other Indonesian cities.

As in the first category of pathways, the four initiatives in this second set of cases also involved relatively short-term, multi-scale pathways (all had a maximum length of two years). However, by investing in a hybrid approach that combined action research at some levels with more traditional research at others, each of these initiatives succeeded in going beyond awareness-raising to progressing new practices, primarily at a local level. For example, the CSA work in Nepal blended action research on the ground with a research approach at national level that combined 'learning from' the local pilots with a modelling approach to scaling up. Similar patterns of action research at a local level stimulated local innovation in Bihar and Kupang, while providing new insights into multi-level governance of financing solutions which have yet to be realised. In Pakistan, the local participatory research in Sialkot had the potential to flow into action; in reality phase 2 saw the emergence of a more action-oriented research approach at national level, which combined further feasibility study with an active search for a viable combination of organisations willing and able to agree a suitable investment model.

Box 6. Indonesia: Financing climate compatible development in Kupang

Kupang is a medium-sized coastal city and port situated on the island of Timor at the south-eastern end of Indonesia. It is the capital city of the province of East Nusa Tenggara (ENT) with a growing population of approximately 350,000. It is vulnerable to rising sea levels, increasing numbers of storms and shortening rainy seasons. CDKN selected Kupang city as a case study because it was not as attractive to donors as other more central and larger cities in Indonesia and, with few international institutions working there, it was thought that a project intervention could make a real difference.[49]

As part of this project, a number of stakeholder dialogues were held to identify city-specific priority sectors and gaps, and to match project ideas with potential finance instruments. In September 2015, some 30 participants (including representatives from the Government of Kupang, local banks and cooperatives, civil society organisations and environment-related small businesses) attended a workshop that helped to establish stakeholder dialogue within the city and bring actors together to work on climate change issues. Attendees included the Bank NTT, a regional bank owned by the provincial and district governments. The bank later announced that it was ready to support initiatives related to environmental protection, encouraging sustainable energy as well as a sustainable and resilient economy, by providing grants.[50]

A national workshop on 'Climate Finance for Cities' was also convened. The project report highlighted the following dimensions of funding climate compatible development in Kupang:

1. Although sources of funds exist at the local level, the fund allocation is often not directed to climate actions.

2. There were action areas not within the city's authority, but under provincial authority, which hindered the city government from making useful interventions.

3. In many provinces, the National Action Plan on Greenhouse Gas Emission Reduction ended at provincial level and was not extended to the district/city planning level.

4. The study also identified the need to improve access to funding at the subnational level. Specific purpose grants (DAK), for instance, could be one of the instruments with which to access funding available for climate action activities. However, this should be supported by amendment of the inter-governmental fiscal transfer via DAK regulation, to reflect climate change aspects.

The project confirmed the perception that second-tier cities struggle to access sufficient funding, but set an example of how a regional bank could contribute grant finance for local civil society projects related to sustainable and environmental outcomes.[51]

Longer-term pathways: Action-led approaches

In this third set of cases we review three climate compatible development initiatives, all from India, where CDKN invested in longer-term multi-scale pathways: one spanning more than three years and the other two over 4.5 years each. All took an action research approach working at multiple scales, and all succeeded in embedding new practices at several scales. The first of these initiatives started at a local level only (in Gorakhpur), but quite soon began to engage at other levels of governance. The other two initiatives engaged at multiple levels of governance from the outset.

Before reviewing these three cases, we introduce two terms that are frequently used to describe different scale-related pathways: scaling 'out' and 'up'. These two scaling mechanisms feature prominently in recent literature on community-based adaptation.[53] 'Scaling out' refers to the process of drawing on insights from pilot work to change practice in other localities, thereby bringing "more quality to more people over a wider geographical area, more equitably, more quickly, and more lastingly".[54] 'Scaling up', by contrast, refers to the process of creating the right policy, legal and institutional frameworks to enable tested solutions that have worked successfully through local piloting to be adopted at a broader scale. Learning from its initial work on scaling, CDKN recently concluded that "there is an urgent need to scale out and scale up pockets of good [climate compatible development] practice and innovation, while preserving the elements that make them locally appropriate and therefore effective".[55]

Scaling up and scaling out are both features of the first case in this category, an initiative to mainstream climate change into district and state disaster risk planning. Here, work was confined initially to a single

district (Gorakhpur) before scaling up to state level and then out to two other district–state systems (Box 7). In retrospect, a series of steps can be identified within this scaling pathway, mainly emergent rather than being present in the original design. During the first (18-month) phase of work, the main focus – which had been designed at the outset – consisted of embedding understanding of climate-related vulnerabilities and uncertainties, and their impact on key systems such as water supply, health, power, housing and agriculture, across the relevant line departments within the Gorakhpur District Government. A 'shared learning dialogue' approach was used to build cross-departmental cooperation and ownership of a more proactive approach to disaster management, which was subsequently reflected in Gorakhpur's climate-smart district disaster management plan (DDMP), published in 2013. Community consultation and representation of the voices of communities in the DDMP was a further feature of scaling within this initial work in Gorakhpur.

Box 7. India: Mainstreaming climate change into district and state disaster management plans

Gorakhpur is recognised as the most flood-prone district in Uttar Pradesh. Flooding has been a regular occurrence, putting the lives and livelihoods of local communities at risk. In its first phase (2012–2013), the aim of this initiative was to respond effectively to more frequent and extreme flooding by proactively planning to minimise loss of life and damage to property.

Initially the programme team, led by the Gorakhpur Environmental Action Group (GEAG), worked with the Gorakhpur District Disaster Management Authority to highlight the urgency, relevance and implications of climate change to the district's plans and programmes. Here a key area of focus was on climate-related vulnerabilities and uncertainties. Understanding was built through a structured and iterative process of workshops and round table discussions – known as 'shared learning dialogues' – with each iteration involving various district departments and conducted in such a way as to develop an appreciation of issues surrounding vulnerability and resilience building. As well as nurturing cross-departmental ownership and cooperation, the process helped officials to identify gaps and opportunities for integrating development programmes with climate-sensitive disaster management, thereby enabling a shift from a response-centric to a mitigation approach to disaster management. This was reflected in Gorakhpur's climate-smart DDMP, published in 2013, and aligned to different departments' needs, priorities and capacities.

Key findings of the process at the district level were then used to promote shared learning dialogues at state level. This resulted in both scaling up and scaling out within Uttar Pradesh, with the State Government writing to all 75 districts in the state directing them to follow the process taken by Gorakhpur. A further output from this first phase of work was the development of a training manual, setting out how to mainstream climate change into DDMPs. Subsequently, the national partner in the supplier consortium, the National Institute of Disaster Management (NIDM), drew on this training manual to provide training to authorities from all 600+ districts in India:

> "It was always very important that the supplier included a government partner – which meant at the district and state level it was taken seriously – and obviously at national level also. I don't think any of the project successes would have happened without NIDM's involvement."[56]

Drawing on contacts established during the training programme as well as previous CDKN work, the second phase of this initiative (2015–2016) saw learning from Gorakhpur applied to the development of revised DDM plans in two other states (Uttarakhand and Odisha), starting at district level (Almora and Puri districts), and with subsequent scaling up to state planning level in Uttarakhand, although scaling was less effective in Odisha.

A second step of the scaling process (scaling up) was introduced when findings from the district-level process were used to promote shared learning dialogues at state level. These state-level dialogues were supported by a number of innovative knowledge products,[57] which distilled the learning from the district-level process and proved important in reaching out to other districts and making the case for them to act. Further, this process led to the Uttar Pradesh State Government writing to all 75 districts in the state directing them to follow the process taken by Gorakhpur. A third, more emergent scaling out process took place as a result of the development of a training manual, which was then used by NIDM to provide training to district authorities from across India.

The fourth step of the scaling process took place in the second phase of this initiative, illustrating a more intentional approach to scaling out and up. Entry into Puri and Almora districts in two new states (Uttarakhand and Odisha) was facilitated in two ways: firstly, through the success of phase 1 in Gorakhpur, which led to the involvement of individuals from Puri and Almora in the training programme, and secondly through earlier work by CDKN in Puri and Odisha state, which had fostered relationships with key individuals in these locations.[58] It is likely that both factors helped shape the overall success of the scaling work in Puri and Almora, with revised DDMPs completed in both districts. However, a number challenges were experienced in Puri and Odisha, both in getting started – district authorities were already working with the UN Development Programme (UNDP) on village disaster management plans and needed to be convinced of the value of a different approach – and in developing effective district–state links to foster scaling up to the state level.

While the overall success of this initiative can be attributed to several factors, taking an action research approach linked with a flexible and emergent approach to design appears to have been key. The composition of the supplier consortium – which brought together the state, district and community experience of the Institute for Social and Environmental Transition (ISET) and GEAG with the national experience and presence of NIDM – was also key to working effectively with scale, enabling nimble movement up and down scales. The knowledge-brokering skills of ISET – including the ability to broker knowledge across scales – made a particularly strong contribution to this process.

Two other initiatives in India also adopted an action research approach, getting into action early at multiple scales and learning and adapting as they proceeded. The first of these took place in Uttarakhand and sought to mainstream climate compatible development into state and district planning processes (Box 8), while the second focused on heat health action in urban India (Box 9). The three-year initiative in Uttarakhand worked skilfully to build understanding of climate vulnerabilities and how these might be taken into account in mainstream planning processes. The approach taken was to build up a picture of vulnerabilities from the perspectives of state, district and community levels, drawing (on the one hand) on a top-down vulnerability risk assessment (VRA) modelling approach and (on the other hand) on bottom-up data from participatory community assessments. During a second phase, an additional process known as stocktaking for subnational adaptation planning (SSNAP) was introduced to further support the state government in thinking through what climate change means and how development and climate change priorities overlap. This process subsequently led to agreement by the state government of an agenda for climate change, to be supported by an up to 1% annual budget commitment from each government department to support climate change adaptation.[59]

> "Working at different scales requires expertise in working with different types of organisations. CHEA [Central Himalayan Environment Association] was very competent at the local (community) level – but other expertise was needed to link this work to the district- and state-level VRA and bring this work into policy. One of the roles we took in Acclimatise was to link partners and help them avoid working in silos."[60]

Initially, there were also ideas to scale out from the Uttarakhand work to other mountainous states in India, including the idea of a regional workshop. However, curtailments to funding prevented this.

A further positive outcome from CDKN's work with the State Government of Uttarakhand was that when a further three-year programme of capability-building for climate change adaptation was launched by UNDP,[64] they agreed to build on the work of CDKN and progress this through further community and policy assessment work and capability-building.

> "We strongly encouraged CDKN to link with UNDP, who were responsible for supporting the preparation of the State Action Plan on Climate Change in Uttarakhand. We felt that there would be significant opportunities if we could get UNDP's buy-in – they have a two-person team sitting in the nodal agency. UNDP subsequently extended our work on the Agenda for Action to encompass other sectors in the state climate plan. This means that CDKN's initial intervention has had a strategic impact in this area."[65]

Box 8. India: Mainstreaming climate compatible development planning in Uttarakhand

Mountainous regions are particularly vulnerable to climate change and have shown 'above average warming' in the 20th century.[61] Uttarakhand is one such region in India, where climate change already exacerbates existing social, economic and ecological vulnerabilities. Following a devastating flash flood in July 2013, the State Government of Uttarakhand approached CDKN to carry out a comprehensive VRA, with the intention to complement work already being undertaken by UNDP[62] and to help better inform climate-related planning.

The VRA was developed using a range of approaches that facilitated understanding of vulnerability at different scales. At the state level, different models were developed for the agriculture, forestry, health, water and flood sectors, indicating for example which areas might be more prone to flooding or landslides, or where different kinds of crops might be needed. Vulnerability indices were then prepared for all 13 districts across the state, both on a sector-by-sector basis and across sectors. The maps were triangulated by looking at examples of community behaviour, adaptation and maladaptation. Drawing on community risk assessments from a range of six villages thought to be more or less vulnerable, the community findings in some cases validated the scientific findings, and in other cases told a different story.

> "This approach of combining scientific VRA modelling and community assessment as a basis for policy advice was new in India, and also drew in international expertise."[63]

To assess and support the ability of decision-makers to make adaptive decisions, the project in its second phase introduced a tool known as SSNAP, a participatory assessment process involving different stakeholders from both within and outside government. SSNAP helped identify adaptation needs, existing capacities and intended future capacities for adaptation planning over a five-year period, and helped stakeholders begin to consider the next steps to reach their goals. The SSNAP approach also proved extremely useful in helping to build links between the different state government departments, for example, between those involved in climate change and those involved in planning, as well as between the state government and the many research and academic institutions working on climate-related issues in Uttarakhand. This in turn led to stakeholder agreement for the state to build the State Climate Change Centre, which was established in August 2016, and to create a platform for knowledge and data sharing, which could be housed in the State Climate Change Centre.

A particularly striking story of working with scale emerges from CDKN's work on heat health action in urban India. This 4.5-year initiative was developed in response to the deadly heat wave that hit Ahmedabad, Gujarat, in May 2010. Starting as a 'supplier-led' project, the focus during the first phase was on the development of a heat wave action plan for Ahmedabad, launched in April 2013. A second phase, starting in September 2014, saw rapid scaling, with heat wave management plans currently (as of early 2017) under development or improvement in 14 cities across five states (Box 9). A national roadmap for effective heat wave management in India has also been published.[66]

In the context of a 4.5-year investment, this initiative stands out as a case of relatively rapid scaling up and out, perhaps because the challenge was mainly one of inter-departmental and multi-stakeholder coordination around a relatively tractable issue. From a scaling perspective, this story highlights:

- The development of strong local ownership and momentum in the early stages of the project (March 2012 to August 2013), where the focus was on Ahmedabad, but where there was also early engagement of key national actors – the Indian Meteorological Department (IMD) and National Disaster Management Authority (NDMA) – reflecting an early design emphasis by the project team on multi-level engagement. This early buy-in at both city and national levels provided a solid foundation for the subsequent 'step change' in scaling that took place.

- In a second phase of the project, identification of champions among state and city officials to attend a workshop in April 2015, based on prior relationships developed through the Public Health Foundation of India (IIPH) nodal points, appears to have been key to what followed. Champions from five states and from several cities across those states attended the workshop.

Box 9. Heat health action in urban India

In May 2010, a deadly heat wave hit Ahmedabad, with temperatures peaking at 46.8°C. Over 4,000 people died during the heat wave, with 30% of deaths subsequently attributed to the heat wave itself.[67] The idea for the project was born (independently of CDKN) at the 'Vibrant Gujarat' summit in January 2011, where the United States (US)-based Natural Resources Defence Council (NRDC), which became the lead supplier for this project, met with the Ahmedabad Municipal Corporation (AMC) and other project partners to discuss how many people actually died in the 2010 heatwave,[68] and what could be done about it. The research funded by CDKN arose out of this conversation.

As the research developed, it became clear that there was no effective early warning system in place in Ahmedabad, as heat data received from IMD was arriving five days later than was required to inform an effective early warning response. As a result, the research team not only undertook research to demonstrate the percentage of heat-related deaths, but also agreed to work with AMC to draw up a heat preparedness plan, adapting existing models from the US and the UK. Drawing on an extensive research and consultative process, the Heat Action Plan for Ahmedabad was launched in April 2013.[69]

National and international recognition of the project for its success in bringing heat health issues to the fore created new interest in climate-induced extreme heat preparedness and demand to scale up this project in India. A second phase was therefore funded to build on this momentum. Drawing on learning from the first phase as well as the rapidly developing interest from other state and municipal governments in India, expansion and scaling out happened on a number of fronts:

> "The scaling out process happened in many different ways. For example, IMD learned about our work from Georgia University in the US, which had been part of the project team in phase 1, supporting Ahmedebad to develop a five-day forecast. From this the IMD agreed to develop a similar process across India. From the start of phase 2, we also kept NDMA and the Gujarat State Government informed of what we were doing. Then in April 2015 we convened a workshop to bring other cities together to learn from our work in Gujarat."[70]

The workshop brought together cities where CDKN's local supplier IIPH already had a local presence. These included: Surat, in Gujarat; Nagpur, in Maharashtra; Bhubaneswar, in Odisha; Hyderabad, in Telangana; and Delhi:

> "For three days we worked through the health action plan manual with the city officials. By the end of the workshop they could see the importance of doing action plans in their cities. What surprised us was their enthusiasm – Maharashtra didn't want just to focus on Nagpur, but to develop five other city action plans, while Odisha wanted to work in three other cities besides Bhubaneswar! Our response was to say we won't do this for you (as we did in Ahmedabad), but we will ask IIPH to facilitate the initial analysis and identify the alert levels with you. But you must develop the communications and mass awareness plans, with local IIPH nodes supporting you."[71]

As a result of this process, a number of different scaling models began to emerge:

- In some cases, the city-run approach originally developed in Ahmedabad (Gujarat) caught on in other cities (i.e. a scaling out process), for example, in Surat, Nagpur and Hyderabad, and in Vijayawada and Amaravati (both in Andhra Pradesh).

- At the same time, these city-led developments inspired state authorities in Gujarat, Telangana and Maharashtra to take the initiative (i.e. a scaling up process). Thus, Gujarat State Disaster Management Authority now plans to develop heat plans for the city of Rajkot, while Surat's heat action plan could help shape a state-level heat plan for Gujarat. The state of Telangana is also developing a state-wide heat plan.

- In Maharashtra, led by the Maharashtra State Public Health Department and Nagpur Municipal Council, the Regional Heat Action Plan coordinates the heat wave response planning in the neighbouring cities of Gondia, Chandrapur, Nanded, Akola and Jalgaon, all of which were adopted ahead of the 2016 heat season.

- Finally, in Odisha, the model is purely state-led, with the Odisha State Disaster Management Authority developing heat action plans for Bhubaneswar, Puri, Koraput and Baleshwar. In this case, the Odisha Heat Action Plan was integrated into the existing state-wide disaster management system.

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> "These developments took us by surprise. Given our resources and timeline available, we never would have imagined such a response. We realised we had seriously underestimated the need! I think one of the things that made the difference was our supplier – NRDC – they motivated city officials to do it for themselves."[72]

At a national level, NRDC, IIPH and key cities also worked with the Indian government to mainstream heat wave planning. For example, IMD supported the scaling up of heat action plans by strengthening and coordinating forecast communication to the cities, while the Indian NDMA with CDKN support developed guidelines for heat-related disaster risk reduction plans to increase communities' resilience to extreme heat and overall capacity in climate adaptation efforts across India.

- The engagement of these champions provided a key foundation for the rapid out- and up-scaling that took place as a result of the workshop. This scaling was emergent rather than planned, leading to a mix of 'self-organising' pathways for developing heat action plans, in some cases city-led, in other cases state-led, and in some cases jointly state-and-city-led.

- While these pathways were state- and/or city-led, ongoing technical support from IMD and NDMA, as well as targeted support from the CDKN supplier team, helped to rapidly progress the pathways. CDKN's knowledge products[73] again played a key role here.

Overall, this story highlights the need to invest adequate time if scaling is to be achieved successfully. The experience from this case was that promising solutions found through piloting in one place can be spread quite rapidly if the right conditions are in place, but that it can take time before these enabling conditions come together in a 'tipping point'. Following this tipping point, processes of learning and adapting were rapid because they were primarily self-organising, taking the principles of what was working in Ahmedabad and testing them out in other places and political contexts.

Regional pathways

Taking inspiration and learning from the heat wave management work in India, in late 2015 CDKN launched a 12-month project to develop a similar approach in Karachi. Precipitated by the intense heat wave of the preceding summer, this project succeeded in developing strong buy-in from stakeholders in support of the development of a heat wave management plan for the city, along with improved understanding of the institutional challenges to be addressed in order to achieve this (Box 10).

In this example, scaling from the heat health work in India extended across the border to a neighbouring city in Pakistan, illustrating a new category of trans-boundary scaling. The possibilities for such trans-boundary scaling can be attributed in part to CDKN's regional presence as a knowledge network covering several countries with a primary focus on Bangladesh, India, Indonesia, Nepal and Pakistan. However, it is likely that the rapid transfer of learning between India and Pakistan was further facilitated by the global network on subnational learning that was co-convened by CDKN and ICLEI - Local Governments for Sustainability between 2013 and 2017 (Box 11).

Box 10. Pakistan: Facilitating Karachi City District Government in heat wave management

This project was an immediate response to the heat wave of June 2015, which killed 1,300 people, many of them elderly. This high mortality rate shocked the city and put pressure on the Karachi City District Government for something to be done quickly. Drawing on its work in India, CDKN initiated a process at local levels which would build towards the development of a heat wave management plan for the whole of Karachi, a mega-city of over 18 million people. The process of stakeholder consultation that followed highlighted that most felt that the responsibility for heat health management lay with the City District Government and that close and effective coordination with other departments was crucial. Stakeholders called for a central repository where all information pertaining to a heat wave and its level of intensity is gathered and can then be shared simultaneously with all relevant departments, as well as the media. In turn, those departments would need to be ready to roll out their plans. The project activities also included other consultative and public engagement workshops, aimed at sensitising and motivating participants on heat wave management planning and processes. The workshops were supplemented through an assessment exercise to establish the capacity, mandate and willingness of local institutes and organisations to contribute to the development and implementation of a heat wave management plan for the city.

After 12 months of activity, the project has achieved the following:

- Enhanced understanding within Karachi City District Government of the need for a 'systems' approach to the design and delivery of a heat health management plan.

- Strong buy-in from stakeholders to support the development of a heat wave management plan for Karachi city.

- Improved understanding of the institutional challenges and knowledge gaps for effective heat wave management in the city.

Box 11. The CDKN–ICLEI subnational learning partnership

This knowledge network was first convened in 2013 for two purposes: firstly, to develop a supportive community of practice among researchers, development consultants and local decision-makers who were designing and delivering climate compatible development at a subnational level; and secondly, to capture and disseminate lessons from CDKN's experience on the success factors and preconditions, drivers and barriers to subnational climate compatible development.[74] The network was supported through a series of online and face-to-face learning events and workshops. Eleven CDKN and ICLEI projects were involved in its first phase, and a different set of 10 projects in its second phase. First phase projects included the climate change/disaster management mainstreaming initiative in Gorakhpur and the Indian heat health initiative, at that point focused primarily on Ahmedabad.[75] Second phase projects included the CSA initiative in Nepal, the NAMA study in West Nusa Tenggara, the renewable energy initiative in Sialkot city and the mainstreaming climate compatible development initiative in Uttarakhand.[76] In addition to stimulating cross-project learning, the partnership has also synthesised a number of 'lessons learned' about working at subnational levels, which have been widely shared through CDKN's broader learning networks.[77]

Design principles for working with scale in climate compatible development

In the previous section we focused on the design of pathways for multi-scale climate compatible development; that is, on the linking of engagement activities at different levels of governance, how these activities were sequenced and interrelated, and the extent to which these activities led to changes in awareness, understanding, relationships and/or practices. A series of principles also underpinned the design of these pathways. In this section, we draw out principles already referenced in the previous section, together with a further set of principles associated with knowledge networking, knowledge brokerage, 'start conditions', and flexible and adaptive management.

Getting into action early

A first principle embedded in our analysis of different multi-scale pathways for climate compatible development reflects the differences between those initiatives that followed a more 'traditional', linear, research-led approach (category 1), those that took a more action-oriented approach (category 3), and those that fell somewhere in between, taking a hybrid approach with an action research framing at some levels but a more traditional research framing at others (category 2). This design principle reflects assumptions and judgments about how changes in climate compatible development practice might come about, in particular the relationship between changes in understanding, changes in relationships and changes in practice. The more traditional research-led approach starts with the assumption that the purpose of research is to inform changes in awareness and understanding, with the hope that these new understandings will then translate into changes of practice ('action') in a linear fashion. By contrast, action research approaches assume a different model of 'learning by doing', and/or of learning through conversations and relationship building between new constellations of stakeholders that might lead early on into learning by doing.

While there is no 'right' approach – and the choice of an appropriate design may be determined by a wide range of factors, including climate compatible development focus, cultural and political economy constraints – our findings from the initiatives reviewed in this report are that those falling into the first category have not (to date) led to changes in practice, while all three in the third, action-led category have led to changes in practice at multiple levels of governance. While the time invested in these different categories may appear to be a confounding factor, it should be noted that all three initiatives in the third category started as relatively short-term projects (less than two years), similar to those in the first category, but were extended into further phases in part because they were able to demonstrate changes in practice/outcome early on.

The four hybrid initiatives in the second category are more difficult to interpret. Like those in the third category, all four demonstrated changes in practice (in three of the four cases this was at the local level) that in principle could have: (a) encouraged and secured a second phase of investment; and (b) led to changes in practice at multiple levels. The main reason why these initiatives were not taken into a second phase is that no further funding through CDKN was available by the time the first phase had been completed (mainly in late 2016/early 2017).

From the above, we might tentatively conclude that, where feasible, more may be learned in practice from getting into action early and then scaling, or from getting into action early at multiple scales, than by starting with a lengthy research process. On the other hand, in some cultural settings, a blended approach may be more appropriate, involving some combination of research and action research. The CSA work in Nepal, the renewable energy initiative in Sialkot and the financing work in Kupang are all illustrative of this approach, which may be more suited to the political economies of these countries than the three more experimental, action-led, multi-scale initiatives undertaken in India.

Flexible and adaptive management

A second design principle, applied across several of the initiatives reviewed in this report, was that of flexible and adaptive management. While this approach was sometimes designed into a project at the outset, it could also be emergent, for example reflecting the ability of a project manager to reflect, admit challenges and then work creatively to find solutions. This is illustrated in the Uttarakhand climate compatible development mainstreaming project:

> "The project manager was honest enough to recognise that the CDKN India team were struggling, that while the supplier consortium had plenty of academic experience, they had less experience in translating VRA into policy. Indeed, a VRA hadn't been undertaken by CDKN India before, so they weren't certain how useful it would be to the state government. By bringing in an independent advisor, CDKN could offer carefully targeted policy advice but without baggage – someone who was in a good position simply to offer his experience and support."[78]

In the CSA project in Nepal, adaptive management was embedded in the project design through a strong emphasis on continuous learning. This is reflected in its action research methodology – a hallmark of the

practice of the supplier, Local Initiatives for Biodiversity, Research and Development (LI-BIRD) – that is reflected both in the piloting work (local action research for and with farmers and extension workers) and in the approach taken by the project to scaling (action research connecting policy-makers in government with the learning emerging through the pilots, and supporting their reflection on how this learning might be scaled out). The flexible, action research-based approach taken by this project was, however, sometimes in tension with the requirement of CDKN and DFID for a detailed logical framework with clearly planned outputs and outcomes. CDKN and LI-BIRD both had to learn and adapt fast to accommodate these different approaches.

In some of the initiatives, internal learning supporting adaptive management was linked to an approach in which the suppliers learned alongside project stakeholders. This feature of project design was most pronounced in the work in India on mainstreaming climate change into district and state disaster management planning, where shared learning dialogues were a central feature. While some of the sequencing within and across dialogues was designed from the outset of the initiative, many of the steps were emergent, both in the initial phase in Gorakhpur and its state-level scaling dimensions, and in the second phase in Puri–Odisha and Almora–Uttarakhand. This flexible, adaptive approach to the unfolding learning dialogues involved the suppliers learning about how to progress through dialogue with stakeholders, even though 'project design' was not explicitly on the table for discussion. It also relied on a supportive and flexible working relationship with CDKN:

> "CDKN gave us a lot of space in terms of how to approach this project. For example, we worked together with CDKN to develop the concept note for phase 2 into a full proposal. We sat together and worked on this. I know of very few other donors who take such an open and flexible approach – it was a rich experience."[79]

The project outcomes, in terms of revised DDMPs, governance changes (improvements in both horizontal and vertical links) and wider scaling outcomes, are testament to the effectiveness of the shared learning dialogues and their adaptive management underpinning.

From projects to pathways

The principle of flexible and adaptive management was of particular significance when combined with CDKN's funding model, which, compared with that of many other donors, is relatively 'light touch' and short term. By investing initially for a maximum period of one to two years, and then reviewing progress, CDKN was able to add a further phase of investment onto those initiatives that were already yielding significant changes in practice, or indicating significant promise in other ways, thereby turning initial project-based experiments into longer-term, adaptive pathways of climate compatible development. Furthermore, these extended development pathways in turn opened up expanded opportunities for working with scale, including through pathways of scaling out, scaling up and multi-level innovation. Projects that were extended in this way – namely, the four initiatives in India, together with the work in Sialkot city and, in other ways, the two projects in Nepal and the supported NAMA work in West Nusa Tenggara – provide examples of the enactment of strategic adaptive management[80] and anticipatory learning.[81]

For the four initiatives in India, the anticipatory or 'strategic turn' was to see the possibilities for further scaling the learning from phase 1. Moreover, this involved more than simply good multi-scale design work. It also involved assembling the follow-up funding within CDKN and a review (and in some cases adjustment) of the makeup of the supplier consortium, to ensure that there was a good fit with the anticipated scaling process.

In the case of the private sector climate compatible development work in Bihar and Uttar Pradesh, CDKN's funding model meant that on the ground it could adopt a nimble and adaptive approach in commissioning the second phase work quite soon after the completion of the first phase. Similarly, in the heat health action work, rapid adaptive learning by CDKN during the second phase supported an effective response by the supplier team to the energy and commitments of city and state officials released at the April 2015 workshop, as well as exploitation of the opportunity for a national roadmap process, including commissioning additional suppliers to undertake this work.

Similarly, in Pakistan, CDKN decided to take a strategic risk in commissioning a second phase of feasibility work on renewable energy solutions in Sialkot city, despite the relatively cautious commitment being expressed by the federal MoCC at the end of the phase 1 work. This then opened up exploration of a broader range of funding models, with the possibility of funding the project either as a NAMA or on its own merits, and engagement of new potential funders and sponsors, including the State Bank of Pakistan and the Asian Development Bank in the former role, and Pakistan's AEDB in a convening role.

By contrast, in Indonesia it proved more difficult to extend the initial research on a supported NAMA in West Nusa Tenggara into a longer-term development pathway, which might have secured financing for the governance reforms required. While we were unable to clarify the reasons for this, the frequent changes of CDKN project managers for Indonesia could have contributed. Another explanation could be that CDKN hoped that a supported NAMA might be secured through the ongoing Dutch- and German-funded MM project with which the supplier ECN was already involved (and to which the CDKN-sponsored West Nusa Tenggara work contributed) and that continued through to 2016. Unfortunately, the focus of the Government of Indonesia shifted from NAMAs to energy conservation, and CDKN was not in a position to champion the West Nusa Tenggara work within alternative funding envelopes.

In summary, the most productive initiatives in terms of impact at multiple scales were those that ran over extended timescales of at least three years and, in two cases, 4.5 years. In this regard, the trajectories of the more successful pathways illustrate the progressive gains of scale over increasing timescales; for example, the 'breakthrough' workshop for the urban heat wave work in India occurred in April 2015, after three years of emerging pathway development, with the national roadmap for effective heat wave management in India following 18 months later. What is interesting, however, is that these extended timescales were not designed into the original phase of work in each of the three category 3 initiatives; rather, they were conditional on early successes. The design principle illustrated here is therefore one of recognising the value of extended timescales to the achievement of climate compatible development impact at multiple scales, but embedded within an experimental, phased and strategic adaptive management approach.

Flexible start conditions

For the initiatives reviewed in this report, flexibility is not only a feature of design throughout the lifetime of the initiative, but is also found within the 'start conditions' of each initiative.[82] The choice of projects in CDKN Asia's portfolio was shaped in part by the generic mix of commissioning approaches across CDKN, which included global and regional research calls, relationship building with targeted in-country partners (particularly in government) as a basis for exploring and co-designing responsive solutions, and, on occasion, 'supplier-led' projects. But alongside these, analysis of the start conditions associated with the 10 initiatives reviewed reveals a broad mix of selection strategies, consistent with the flexibility of CDKN's approach.

Trigger events: shocks and stresses. Several projects emerged (sometimes quite rapidly) in response to shocks or stresses. These trigger events included the shocks of the flash flood of July 2013 in Uttarakhand and the extreme heat waves in Ahmedabad (May 2010) and Karachi (2015); and the more gradual stresses of load shedding in the Punjab (Sialkot) (which by 2014 was leading to significant economic losses) and the recurring impacts of local flooding in Gorakhpur.

In combination with other strategies, CDKN's ability to be 'in the right place at the right time', and to be able to move quite quickly and flexibly to design and finance a response around these triggers, resulted in several significant streams of subnational work in India and Pakistan.

> "We have developed an ability to design complex projects by forging partnerships with market leaders, the private sector, national and subnational governments and implementation partners, and to develop agile contracting that enables quick implementation."[83]

National policy or local priorities? While initiatives were often designed around local priorities, including trigger events such as those above, in some instances national policy could also act as a driver. In both Indonesia and Pakistan, the national NAMA framework was used to shape research and

stakeholder engagement around the search for locally appropriate solutions, with a focus on renewable energy investment, both in West Nusa Tenggara and in Sialkot. Elsewhere, India's national Disaster Management Act (2005), together with its National Action Plan on Climate Change (2008), helped to shape the work on climate compatible disaster risk planning in Almora, Gorakhpur and Puri, while in Nepal it was the priorities of MoAD that led to the testing of climate-smart technologies in three contrasting pilot sites in different parts of the country.

Planned or opportunistic interventions? CDKN Asia proved adept at both planned and opportunistic interventions. At one end of the spectrum lay CDKN's planned investment in building relationships with government, thereby encouraging requests for technical assistance. Before it started work on mainstreaming climate compatible development planning in Uttarakhand, CDKN had built a relationship with the state government through a previous project focusing on climate change and gender, while in Pakistan's Punjab, early contact and collaboration with the provincial government in 2011 subsequently led to a request in 2014 for technical assistance on renewable energy solutions in Sialkot.

Three of the four initiatives in India were selected through open calls, which were planned in terms of the framing of the call, but opportunistic in terms of the response. An open call by CDKN in 2012 led to a response from GEAG and ISET, opening up the 4.5-year collaboration with CDKN around climate compatible disaster risk planning. Likewise, an open research call in 2013 led to the 4.5-year collaboration around heat wave management, while an open research call in 2014 on climate compatible development work with the private sector led to the collaboration on franchise models for diesel to renewable energy conversion in Bihar and Uttar Pradesh.

Other initiatives were even more opportunistic. Supplier-led projects fall into this category, as well as projects enabled through trigger events. The research in West Nusa Tenggara provides one example of a supplier-led project, sparked through work that CDKN was doing in Africa with the supplier ECN, enabling it to piggyback on an established ECN project in Indonesia.

Trust and the importance of established relationships. In several of these initiatives, previous investment by CDKN in relationship and trust building was undoubtedly an enabling factor in the project getting off the ground. For example, both subnational projects in Nepal resulted from previous relationship building with MoSTE and, subsequently, with MoAD and the Ministry of Irrigation. Through his reputation and experience, the country engagement leader played a key role in this relationship-building process.

Equally, counterparts within government or private sector partners who played a strong role in championing climate compatible development within their organisations also had a critical role to play in ensuring that new CDKN-sponsored initiatives got off the ground in their early stages.

Finding contextual fit

All of the design principles we have discussed so far – getting into action early, taking a flexible and adaptive management approach, working with flexible start conditions and converting promising, project-based experiments into longer-term multi-scale pathways – point towards the need for design approaches to be uniquely tailored to a range of contextual factors. The diversity of the multi-scale climate compatible development initiatives reviewed here further reinforces this principle, reflecting several factors. Firstly, these 10 initiatives focused on substantially different aspects of climate compatible development, with three focusing on low-carbon development (Boxes 1, 3 and 4), three on climate compatible development in cities (Boxes 6, 9 and 10), and four on mainstreaming climate compatible development into sectoral planning and practice (Boxes 2, 5, 7 and 8). Secondly, these initiatives were situated within four different countries, each with very different political economies (even though certain patterns of similarity can be found across them) and, in some cases, further compounded by significant differences of political economy within each country, for example, across India's 36 states and union territories,[84] Indonesia's 34 provinces[85] or the eight provinces and other administrative regions of Pakistan.[86] Last, but not least, each initiative was designed and implemented by a different supplier team, varying the mixes of skills and experiences, and working with alternative configurations of stakeholders with different levels and types of agency, partnership, conflict, patronage and leadership.
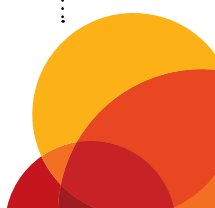
This diversity of approaches to working with scale is consistent with arguments in the academic and practitioner literature that climate compatible development is a highly contextual process and cannot simply be 'replicated' or 'transferred' elsewhere.[87]

Knowledge networking and brokering

The final principle for designing with scale considered in this report is concerned with knowledge networking and brokering:

> "Most of our subnational work is about knowledge networking. At the heart of what we do is a collaborative approach to knowledge production – it is all about who is involved. For example, we bring together state government and scientists to do vulnerability mapping together – an 'unlikely partnership'. And we link micro, meso, macro and meta levels of governance to understand what is needed. We produce knowledge all across the project cycle – for example, it might be used for planning purposes, or for broad dissemination at the end of a project. And we are very versatile in our visual vocabulary – for example, making use of infographics as well as the written word."[88]

As its name suggests, the Climate and Development Knowledge Network (CDKN), both globally and in Asia, places considerable emphasis on the way in which knowledge relevant to climate compatible development is generated, shared and embedded.[89] In terms of 'relevance', CDKN recognises not only that "people need trusted information about climate change",[90] but also that they need "information that is highly relevant to their situation"[91] and, in particular, knowledge that can effectively bridge between understanding the drivers and impacts of climate change, the forces that shape vulnerability and build resilience, and solutions that are compatible with development priorities. This calls for a range of skills, both among CDKN staff and their suppliers, often referred to as 'knowledge brokering'.[92]

Building understanding of climate compatible development. The 10 initiatives reviewed highlight the range of knowledge brokerage strategies drawn on by CDKN Asia in its work. In several initiatives, an early need was to help key partners understand what climate compatible development meant, both conceptually and in practice. Often this involved finding ways to translate between detailed technical discourse and simpler language closer to that of particular stakeholders:

> "People said – this isn't new, we already have agro-ecological agriculture, sustainable agriculture, and so on. But when we explained, then people were more convinced. We presented a framework – what to do and what not to do in climate-smart agriculture – for example, increase productivity and reduce vulnerability. The Ministry of Agriculture confirmed that we had been able to clarify things for them."[93]

> "TARA provided a very good conduit between the two worlds, translating the technical work (contractual terms and conditions) developed by cKinetics into accessible 'ways of understanding and working' at community level. For me, knowledge brokering is key to this kind of work, both in the early piloting and in the scaling up."[94]

In Uttarakhand, the SSNAP tool was adapted to help decision-makers understand where and how development and climate change priorities overlap:

> "Initially, the state government did have concerns that it was such an intensive process. But once the workshop was completed they were very pleased – because it really got them to think about what climate change means, and how development and climate change priorities overlap."[95]

Bridging different ways of understanding climate compatible development. As well as finding ways to make core concepts more accessible, knowledge brokerage may also involve bridging different ways of thinking and understanding, reflecting different actors' interests and stakeholdings. In the climate compatible development planning work in Uttarakhand, the project team combined a top-down VRA approach with bottom-up community assessments; this brought to the surface contradictions between the scientific and community findings. The work on heat health in Ahmedabad also involved bridging between stakeholder, scientific and policy perspectives, with extensive consultation with vulnerable

stakeholder groups, as well as intermediation between technical- and policy-relevant knowledge. The effectiveness of this approach to knowledge brokerage is reflected in the agreement reached in 2013 on the Ahmedabad Heat Action Plan.

Facilitating effective participatory processes. Knowledge brokerage is not just about knowledge content, but also about the relationships in which that content is shared and generated. Indeed, 'meaning making' can be as much about relational and institutional settings as it is about content. Participatory processes were an important feature of almost all the cases reviewed, with the skill of convening and facilitating dialogue between stakeholders key to the effectiveness of these processes. In the renewable energy initiative in Sialkot city, the development at the outset of a stakeholder mapping and partnership-building strategy led to the engagement of over 100 Sialkot industrialists in workshops; this and the strong leadership demonstrated by the provincial government were highlighted as early successes of this initiative. Likewise, in the heat wave work in Karachi, engagement with an extensive cross-section of stakeholders, both within the Karachi City District Authority and outside it, was seen as effective:

> "There was considerable engagement of local authorities, local civil society and grassroots organisations. While only a few workshops were conducted, the overall participatory approach did develop knowledge and capacity of relevant stakeholders."[96]

Action-oriented knowledge. However, knowledge is not just about understanding and relationship, it is also about action. While the relationship between knowing and doing can vary between cultures, initiatives reviewed for this report that took an action research approach were more successful in embedding new practices at multiple scales, as we have already seen. One of the more innovative approaches to brokering engagement between multiple stakeholders and linking this to action was the approach taken through shared learning dialogues to support the mainstreaming of climate change into district disaster management planning in Almora, Gorakhpur and Puri. As previously discussed, shared learning dialogues were used, both to build cross-departmental understanding and collaboration at district level and, in two of the three states, to build new understanding between state and district actors, leading over time to a paradigm shift from a response-centric to a mitigation approach to disaster management:

> "The rich experience of GEAG and ISET in designing and conducting the shared learning dialogues with the district disaster management authority and its member departments catalysed the joint understanding of key gaps, issues and challenges."[97]

In Nepal, another innovative approach to developing action-oriented knowledge was to involve stakeholders, not only in dialogue processes, but also in data collection. Firstly, local farmers and water users associations (WUAs) were interviewed for their perceptions of climate change and its effects. Following this, the WUAs were involved directly in the research through data collection on climate, irrigation management and performance. These locally embedded cases were then used to engage policy-makers from MoAD, both in learning about CSA and in considering how this might be implemented at scale.

Knowledge brokering for working with scale. Given the focus of this report on working with scale in climate compatible development, what is distinctive about the initiatives reviewed is the way in which the different knowledge brokerage skills and practices described above were brought together in a range of designs for working with scale. This also involved strategies for networking knowledge across scales, a key element of which lay in the careful selection of supplier partnerships and consortia. Often this involved building synergies within consortia that brought together local, national and international knowledge, experience and connections. In the CSA project in Nepal, the partnership between the suppliers LI-BIRD and CCAFS was able to maximise synergies between local knowledge and experience, and international expertise, while in the Sialkot renewable energy work, there was also a close and effective partnership between the in-country and international suppliers PITCO and Ecofys (Netherlands). In the latter case, the partnership worked because it was able to leverage a rich mix of skills, including convening and facilitating multi-stakeholder dialogue, generating new knowledge through targeted research and analysis, and effectively packaging and communicating new knowledge to appropriate stakeholder groups.

Conclusions

In framing this report, we focused on the challenges of coordination, multi-scale governance, and the design of effective interventions for climate compatible development. Setting these challenges against the scale of transformational change required for effective climate compatible development globally, we have argued for the value of extensive experimentation with design strategies, and of learning from this experimentation.

To stimulate such learning, we have examined one set of 'design experiments', managed by CDKN Asia across four countries and over a seven-year period. As well as directly benefitting the many and diverse stakeholders involved, these experiments have yielded a rich set of findings and insights to support others. In particular, we have noted the value of initial investments in climate compatible development pathways that are relatively 'light touch' (maximum two years), action-led, reflexive and engage actors at multiple levels of governance. By building learning loops and adaptive decision points into such pathways, those experiments that yield promising results during the initial period can then be extended, both to further embed initial successes and to explore these in other contexts, either through processes of scaling out and up, or through expanding multi-level innovation processes already in train.

In addition, we highlight the highly contextualised nature of every climate compatible development pathway, and the consequent need to design for multi-scale climate compatible development pathways by drawing on the principles discussed in this report, while also taking particular account of cultural, political and economic contexts in selecting appropriate knowledge brokering practices.

List of acronyms

AEDB	Alternative Energy Development Board (Pakistan)	MM	Mitigation Momentum
AMC	Ahmedabad Municipal Corporation	MoAD	Ministry of Agriculture and Development (Nepal)
CCAFS	Climate Change, Agriculture and Food Security	MoCC	Ministry of Climate Change (Pakistan)
CDKN	Climate and Development Knowledge Network	MoSTE	Ministry of Science, Technology and Environment (Nepal)
CHEA	Central Himalayan Environment Association	MW	Megawatt
CSA	Climate-smart agriculture	NAMAs	Nationally Appropriate Mitigation Actions
DAK	Specific purpose grant (Indonesia)	NDMA	National Disaster Management Authority (India)
DDMP	District disaster management plan	NDRC	National Resources Defence Council (US)
DEC	Deep engagement country	NGO	Non-governmental organisation
DFID	Department for International Development	NIDM	National Institute of Disaster Management (India)
DRE	Decentralised renewable energy	NTT	Bank Nusa Tenggara Timor (Indonesia)
ECN	Energy Research Centre of the Netherlands	PITCO	Pakistan Industrial Trading Corporation
ENT	East Nusa Tenggara (Indonesia)	PV	Photovoltaic
ESDM	Ministry of Energy and Mineral Resources (Indonesia)	SDGs	Sustainable Development Goals
GEAG	Gorakhpur Environmental Action Group	SMEs	Small- and medium-sized enterprises
GIS	Geographical information system	SSNAP	Stocktaking for subnational adaptation planning
ICLEI	International Council for Local Environmental Initiatives	TARA	Technology and Action for Rural Advancement
IIPH	Public Health Fund of India	ToC	Theory of Change
IMD	India Meteorological Department	UK	United Kingdom
IPP	Independent power producer	UN	United Nations
ISET	Institute for Social and Environmental Transition	UNDP	United Nations Development Programme
		US	United States
LI-BIRD	Local Initiatives for Biodiversity, Research and Development (Nepal)	USAID	United States Agency for International Development
		VRA	Vulnerability risk assessment
		WUA	Water users association

Annex: Methodology

This annex provides a brief summary of the methodology that underpinned the 'Learning from seven years of CDKN in Asia' project, of which this paper is a primary output. The methodology was developed in response to a requirement from CDKN for an approach which was to be embedded within a 'learning framework'.

Learning framework

We began by clarifying how learning is understood within CDKN Asia and in particular what is meant by a 'learning framework'. CDKN clarified that a learning framework provides a clear outline of:

- the question(s) we are trying to answer (what do we want to learn about?)

- the audience (who wants to use the learning and how?)

- the learners (whose learning is it and who is learning?)

- evidence base (what sources of knowledge are relevant to the questions, and how will these be selected?)

- methods for supporting learning (e.g. interviews, learning exchanges, webinars, literature review, document review, round table conversations, focus group discussions)

- outputs.

Learning questions. In line with this learning framework, a set of learning questions was selected through conversations with and feedback from a number of CDKN staff in Asia, and later from the global CDKN team.

The set of learning questions agreed is shown below. These questions were at two levels, focusing firstly on the overall story of subnational strategies in each country and across the five deep engagement countries (DECs), and secondly on the stories of particular projects within these DECs. The following eight questions were selected, with question 4 of particular relevance for the paper:

1. How did the subnational strategies in each country unfold? What have we learned about the choice of subnational places/projects in order to achieve results (e.g. local ownership, connection to national policy-making process)?

2. What strategies, measures and practices were used to ensure effective policy implementation or delivery at subnational levels? What did or did not work, in what contexts, for whom, and why?

3. What were the main barriers and enabling factors that CDKN encountered and worked with in implementing these subnational projects?

4. What have we learned about the potential for scaling out and up and how this happens? How did individual projects work with scale (scaling up and/or out), how effective were they, and why?

5. To what extent has our subnational work led to enhanced capability (and of whom) for the long term and under what conditions?

6. To support its subnational work, how effective was CDKN in leveraging its niche and comparative advantage as a leading global climate and development alliance?

7. What seem to be the critical (general and sectoral) integration challenges at the subnational level from our work to date, and/or what does this suggest might be the priorities for any successor work to CDKN?

8. How was learning with and through subnational projects approached, supported and shared? How effective were these learning approaches, and why?

Methodology and methods

Methodology. Given the short timescale of the project (4 months), a simple methodology was used. An appreciative and enquiring approach was taken, both in interactions with key informants (through email exchanges and voice-over-internet interviews) and in the narrative form of the report. Interactions with key informants were designed to encourage questioning and reflection through surfacing tacit as well as explicit knowledge, while also enabling us as facilitators to gather information, knowledge and experiences.

We also drew on the methodology of learning history to shape the narrative form of the report. Learning history is an action research approach to capturing the learning from a project or initiative in a way that emphasises the human experience of those involved. It also involves a participatory process that is designed to stimulate wider, generative learning from those experiences.[98] In a learning history document, diverse experiences and perspectives are woven together to create a story of a project or initiative. While we were not able to draw on the participative aspect of learning history, we sought to bring out moments of human experience by combining analysis and story in the learning report.

Finally, adopting an enquiring approach meant that even within the relatively short timescale of this assignment, as consultants we were open to iterative, reflexive, adaptive and emergent ways of working.

Methods

Document analysis: Document analysis formed an important part of the learning resources for this assignment. Document analysis drew on the following data sources: (i) CDKN project reports and Inside Stories; (ii) reports from the project 'Subnational Climate Compatible Development: Learning from CDKN's Experience'; and (iii) recent CDKN evaluations and country impact studies.

Email conversations and in-depth voice-over-internet interviews: Key informant interviewees were identified at different levels and email conversations and/or interviews held with them to obtain relevant information, experiences and perspectives according to their respective roles. Email conversations and/or interviews were also used to offer brief but appreciative spaces in which interviewees might reflect. At regional level, key informants were selected from the CDKN Asia team. At national and subnational levels, in Bangladesh, India, Indonesia, Nepal and Pakistan, key informants were selected from the CDKN teams, project implementing partners and primary project beneficiaries.

Feedback spaces: Given the timescale of the project, spaces for feedback were limited. A single round of feedback was provided to comment on the draft inception report, on the draft of an initial internal learning report and supporting case studies, and on a draft of this report. All quotes were validated and permission to use them obtained.

Sampling: A three-tier sampling approach was applied to the full database of 72 projects undertaken by CDKN in its five DECs over the period April 2009 to March 2017:

- The first tier involved clarification and selection of 36 'subnational' and other projects that were relevant to this report, from within the full database of 72 projects.

- From these 36 projects, we then selected 21 projects (tier 2) for further in-depth interviews and document analysis.

- From these 21 projects, we developed the 10 stories (tier 3) that provide the focus for this report. Here, some projects were clearly interrelated and could be linked together to shape a single pathway – and story – of climate compatible development. Other projects were discarded following interview, and were not subjected to further analysis.

The critical sampling decisions were concerned with the selection of second-tier projects and key stakeholders associated with these. In making these sampling decisions we drew on the following criteria:

- the need to balance rigour (including issues of breadth, depth and quality of interviews), inclusiveness (including sufficient spread and inclusion across the five DECs) and feasibility (recognising limitations of resources and timescale)[99]

- the need to cover key areas of subnational focus (e.g. cities; state action plans)

- the need to balance breadth and depth across project themes, including adaptation, agriculture and food security, capability development, climate compatible development, disaster risk reduction and disaster insurance, finance, forestry, gender, heat waves, low-carbon development, private sector, resilience and the water–energy–food nexus

- the need to focus on breadth and depth of experience across project themes (for the purposes of learning), while also giving consideration to the future focus of any successor work to CDKN (in terms of positioning)

- the need to give space to emergent themes and insights, and to adapt our sampling approach where appropriate.

Interview protocols: A range of interview protocols was used, depending on whether the main aim of the interview was to focus on the 'bigger picture' stories or the project stories.

Limitations of the design
There were two main limitations to the design as it unfolded in practice.

The first, broader limitation of this piece of work as a learning initiative is that resources did not allow for face-to-face spaces for social learning,[100] in which CDKN staff might be brought together to reflect and make sense together, as had originally been envisaged. Rather, a single webinar was held after completing this report.

A second limitation was that it proved difficult to schedule interviews within the original timescales agreed for the review. As many of the projects under review had already been completed, persuading staff or suppliers who were no longer working for CDKN to schedule time for an interview was in many cases problematic.

Endnotes

1   Mitchell, T. and Maxwell, S. (2010) 'Defining climate compatible development'. CDKN Policy Brief. London: Climate and Development Knowledge Network, page 1.

2   While Bangladesh is also one of the deep engagement countries, because of its strong unitary nature, with no provinces or states, it was difficult to identify any significant subnational work carried out by CDKN.

3   The Sendai Framework for Disaster Risk Reduction 2015–2030 was adopted at the Third UN World Conference in Sendai, Japan, on 18 March 2015.

4   The Addis Ababa Action Agenda on financing for development was agreed on 16 July 2015. See: www.un.org/esa/ffd/ffd3/press-release/countries-reach-historic-agreement.html

5   The UN Sustainable Development Goals were adopted on 25 September 2015. See: www.un.org/sustainabledevelopment/sustainable-development-goals/

6   The Paris Climate Change Agreement was adopted by consensus on 12 December 2015. The agreement went into effect on 4 November 2016.

7   www.eco-business.com/opinion/climate-action-and-sustainable-development-as-one-agenda-simple-truth-complex-task/. Patricia Espinosa is executive secretary of the United Nations Framework Convention on Climate Change (UNFCCC).

8   www.unisdr.org/archive/52502. Robert Glasser is the UN special representative of the Secretary-General for Disaster Risk Reduction.

9   'Scale' can be understood in a multitude of ways, for example as levels or units of analysis which may include spatial (geographical space), temporal (time frames related to rates, durations or frequencies), jurisdictional (clearly bounded and organised political units, e.g. towns, counties, provinces and nations), managerial (management response and change), network (internal structures of social networks such as family, kin and society) and knowledge dimensions (gap between highly generalised and generalisable understanding) (Cash, D.W., Adger, W., Berkes, F., Garden, P., Lebel, L., Olsson, P., Pritchard, L. and Young, O. (2006) 'Scale and cross-scale dynamics: Governance and information in a multilevel world', *Ecology and Society* 11(2): 8). Scale can also be understood in terms of a change in depth, sustainability and ownership (Coburn, C.E. (2003) 'Rethinking scale: Moving beyond numbers to deep and lasting change', *Educational Researcher*, 32(6): 3–12). In this report, we focus on scale in jurisdictional terms, that is, linking across local to provincial and national (and sometimes regional) levels of administration.

10 See also: Anton, B., Cambray, A., Dupar, M., Westerlind-Wigstroem, A. and Gogoi, E. (2014) 'Close to home: Subnational strategies for climate compatible development'. Working Paper. London: Climate and Development Knowledge Network.

11 Pahl-Wostl, C. (2009) 'A conceptual framework for analysing adaptive capacity and multi-level learning processes in resource governance regimes', *Global Environmental Change* 19: 354–365.

12 Source: Cutter, S., Osman-Elasha, B., Campbell, J., Cheong, S.M., McCormick, S., Pulwarty, R., Supratid, S. and Ziervogel, G. (2012) 'Managing the risks from climate extremes at the local level', in Field, C.B., Barros, V., Stocker, T.F., Qin, D., Dokken, D.J., Ebi, K.L., Mastrandrea, M.D., Mach, K.J., Plattner, G.K., Allen, S.K., Tignor, M. and Midgley, P.M. (eds) *Managing the risks of extreme events and disasters to advance climate change adaptation. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change*. Cambridge and New York: Cambridge University Press.

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35 https://cdkn.org/2017/03/feature-a-franchise-for-climate-smart-electrification/?loclang=en_gb

36 Five pilot sites in Bihar and Uttar Pradesh were chosen from 50 shortlisted sites, among communities where TARA already had a working relationship.

37 For the pilot work, venture capital was supplied by the Rockefeller Foundation.

38 Aditi Paul, project manager, CDKN India.

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58 CDKN had previously worked in 2012–2013 with district authorities in Puri and state authorities in Odisha on a related project, 'Getting Smart for Climate Disasters'.

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About CDKN

The Climate and Development Knowledge Network (CDKN) supports decision-makers in developing countries in designing and delivering climate compatible development. It does this by combining research, advisory services and knowledge-sharing in support of locally owned and managed policy processes. CDKN works in partnership with decision-makers in the public, private and non-governmental sectors nationally, regionally and globally.

About LEAD Pakistan

This year, LEAD Pakistan completed 20 years of leadership in environment and development. It takes pride in being the largest network-based organisation in Pakistan with close linkages and presence - regionally and globally.

It has a history of successful delivery of more than 180 development initiatives, and looks forward to producing greater developmental impact through sophistication in design and implementation of projects and interventions.

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Working through an international network with core values of collaboration and inquiry, Emerald Network is a leading-edge niche consultancy specialising in social and institutional learning for climate resilient and sustainable development. As well as designing short- and medium-term learning events and processes, Emerald Network has an international reputation for pioneering the development of long-term, multi-level institutional learning processes for transformational adaptation.

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