Chapter **10**

Strengthening Institutional Capacity for Disaster Management and Risk Reduction through Climate Resilient Agriculture

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CHAPTER 10

Strengthening Institutional Capacity for Disaster Management and Risk Reduction Through Climate-Resilient Agriculture

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10.1 Introduction

The frequency of natural disasters, especially storms and floods, has been increasing globally over the last several decades (Asian Development Bank (ADB), 2013). In the Asia-Pacific region, the number of hazard events increased from around 80 per year during 1990–1992 to 130 during 2015–2017 after peaking at 144 during 2005–2007 (Food and Agriculture Organization of the United Nations (FAO), 2018). Developing countries are especially vulnerable to such disasters but are often the least capable of coping with the associated impacts because of their limited adaptive capacity (Davies et al., 2008). Despite the increased interest in strengthening institutional capacity, it remains a challenge for many developing countries. Institutional capacity for disaster management and risk reduction can be built through various mechanisms. One key approach is via the agriculture sector, where climate-resilient agriculture (CRA) has become an effective tool for adapting to climate change and developing resilience in the long run – resulting in increased capacity for disaster management and risk reduction at the system, institutional, and individual levels. In this chapter, we provide examples of different technologies and practices being adopted to reduce the negative impacts of climate change. Using this information, we explore the potential interventions needed to build institutional capacities for scaling up such practices and develop an institutional framework that can be used to build capacity.

International research has increasingly demonstrated the devastating risks of climate change in coastal regions – particularly for countries with extensive, low-lying stretches of coastal land – caused by rising sea levels. The damage caused by climate change will affect agricultural land, and consequently food security, in many developing countries. However, despite the increased attention given to climate change issues at the global level, there has been minimal organised effort to react appropriately through policy action at the country level. All food policy interventions are designed and implemented by domestic actors (Timmer, 2013). There is a pressing need to understand what is required to develop and implement effective policies that promote CRA, i.e. policies targeting disaster management and risk reduction.

Evidence on the negative impact of climate change on crop production and food security continues to mount (Porter, et al., 2014). This is especially bad for marginal and small farmers in developing countries. Hunger appears to be on the rise, affecting about 11 million people globally, and climate change is expected to increase both the quantity and intensity of extreme climate hazards such as extreme temperatures, floods, droughts, heatwaves, wildfires, and storms (FAO, 2013).

To address the issue, the concept of CRA was launched in 2009 with the aim of providing globally applicable principles for sustaining agriculture productivity to meet the demands of the growing population despite climate change (Lipper and Zilberman, 2018). CRA refers to a bundle of interventions in agriculture, with the aim of increasing yields, placing more carbon in soils, and achieving greater resilience to heat and drought (FAO, 2010).

Certain techniques and practices are being adopted in both developing and developed countries to decrease the negative impact of climate change and greenhouse gas (GHG) emissions while sustaining crop productivity and profitability. This chapter provides examples from four countries (Bangladesh, Ghana, India, and Viet Nam) of different CRA practices and techniques currently being implemented. Further, this study identifies the major constraints and challenges faced by these countries in scaling up CRA practices. While the chapter discusses difficulties faced at the individual, institutional, and system level, we primarily focus on institutional challenges.

Policymakers and institutions face constraints such as lack of awareness amongst farmers, inability of famers to understand and adopt CRA techniques, and lack of government support to scale up efforts to increase climate-smart techniques. Further, all four countries have limited human and institutional capacity to adopt and implement CRA (Babu and De Pinto, 2017). It is crucial to identify the barriers faced by different countries to scale up CRA techniques and practices since they have implications for food security.

Despite increased emphasis on enabling farmers to cope better with the changing climate while increasing yield, farmers continue to suffer because of changing climate patterns. Results from the case studies show a lack of incentives for farmers to adopt CRA techniques and a lack of awareness of their benefits (for both farmers and the environment). There is a need to transform the current food system to meet the demand of the growing population and to sustain agricultural productivity and profitability despite the negative impacts of climate change.

The rest of the chapter is organised as follows. Section 2 provides examples of new technologies and practices being adopted in developing countries and identifies areas for building institutional capacity. Using the information in section 2, we develop a framework which can be applied to strengthen institutional capacity for disaster management and risk reduction. For the purpose of this chapter, we have focused on strengthening capacity for building the resilience of the agriculture sector to climate change and variability as an example. However, this framework can be applied to different sectors to build institutional capacity as an early warning system. The concluding remarks are presented in section 4.

10.2 Strengthening Institutional Capacities for Disaster Management and Risk Reduction

In this section, we first explain why building the capacity of the agriculture sector is a crucial mitigating risk associated with climate change and variability. We then identify technologies and practices adopted by farmers from Bangladesh, Ghana, India, and Viet Nam to build resilience in agriculture for climate change and variability. Using this information, we identify capacities needed at the institutional level that need to be built to reduce the cost associated with natural disasters and mitigate risk.

Agriculture is the engine of growth in many developing countries. The impact of climate change is predicted to be most significant in communities that rely primarily on agriculture for their livelihoods. Hence, it is important for countries to reform and develop policies in agriculture and aligned sectors in order to adapt to and mitigate climate change while continuing work towards food security.

According to estimates, with the current rate of increase in the world's population, food production needs to increase 60% by 2050 (FAO, 2014). Additionally, climate change is making it difficult to increase production capacity. Farmers need to adapt quickly to changing the natural environment and build resilient food systems (Babu and Blom, 2014). They also need to increase productivity, with less damage to the environment, by using sustainable solutions which work in the long term.

A number of attempts have been made to develop models for analysing capacity in the context of climate change and agriculture. Zurek et al. (2014), for instance, use the United Nations Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation (REDD+) in Developing Countries framework and apply it to the agricultural sector to test the 'agricultural climate change readiness'. Wollenberg, Zurek, and De Pinto (2015) took this study a step further and identified six work areas for national readiness in agriculture. Similarly, Richerzhagen and Scholz (2008) structured their study on China's capacity for mitigating climate change on three pillars: structural features of the economy and society, the political and institutional infrastructure for climate change, and the information flow on climate-related matters.

Development efforts over the past few decades clearly indicate that a country's capacity to develop and enforce effective, evidence-based policies is a crucial factor in achieving economic growth, reducing poverty, and building ecosystem resilience and sustainability. Agriculture continues to be the main engine of growth in many developing countries. The influence of climate change is predicted to be larger on communities that rely primarily on agriculture for their livelihoods. Within this context, there is an increased need to reform existing policies and develop new policies on agriculture and aligned sectors to adapt to and mitigate climate change while continuing to work towards food security (World Bank, 2008). However, weak and inadequate organisational and institutional capacities in developing countries severely challenge their ability to develop and enforce policies to manage disasters (Byerlee, de Janvry, and Sadoulet, 2010; Adebayo, Babu, and Rhoe, 2009; World Bank, 2008).

Most importantly, the population most vulnerable to climate change relies on agriculture for its livelihood. The FAO (2018) identifies how climate-related shocks have impacted the employment and wages of people in Asia and the Pacific; and estimates the number of people directly affected in Fiji, Myanmar, the Philippines, and Sri Lanka. Hence, developing countries face a number of challenges in adopting sustainable agriculture policies and practices. On one hand, these countries are burdened with food security issues caused by the increasing population and low agricultural production. On the other, they are under pressure to adopt agricultural practices that cause less harm to the environment. To overcome these challenges, we need to tailor practices for different agricultural zones, making additional financial investments and developing skills. Weak policymaking capacity is also evident in many developing countries. Targeted capacity building programmes can play an influential role in preparing a country's agriculture sector to deal with increasing threats of climate change. The concept of CRA encompasses the challenges mentioned above, giving a more holistic dimension to issues in agriculture.

The transformation of CRA involves many challenges. Policymakers often have to weigh up the costs and benefits of adopting or implementing certain policies. In the case of climate change, trade-offs are a major issue, especially because efforts in the present are realised much later in the future. In particular, if climate adaptation and mitigation goals are pursued separately from those of agricultural production, problems become more difficult to diagnose (Rosenzweig and Tubiello, 2007; Verchot et al., 2007; Smith and Olesen, 2010). This is because, on one hand, agriculture is the biggest contributor to GHG emissions in developing countries, but on the other, transformation towards CRA can mitigate climate change risks to a great extent.

CRA is location- and time-specific. This means that climate-smart practices will differ by region, the crop grown, and over time. Hence, overarching solutions are not useful for countries with diverse agroecological zones. Additionally, since CRA is a bundle of practices, its adoption and implementation require farmers' capacities to be built. Streck, Burns, and Guimaraes (2012) identify three major types of barriers to the adoption of improved agricultural practices amongst farmers – investment, social/institutional, and technological. According to the authors, incentives for farmers to change practices should be tailored according to local realities and supported through general enabling socio-economic conditions. While they write in the context of smallholder farmers, these barriers are also applicable to farmers with large landholdings.

The literature on capacity development, with slight variations in terminology, appears to come to the consensus that capacity has three dimensions: individual capacity, organisational capacity, and system capacity/enabling environment (Organisation for Economic Co-operation and Development–Development Assistance Committee (OECD–DAC), 2009). This commonly used three-pronged approach will form the basis of our definition of capacity, hence moving away from including 'networks' as an additional dimension (OECD, 2005; OECD, 2011; Baser and Morgan, 2008).

Individual capacity is often thought of as one's knowledge, skills, and attitudes, i.e. one's awareness and understanding of a particular situation, issue, or area; one's technical ability to react, predict, analyse, or solve in a critical way; and one's personal motivation to apply oneself to the task at hand. Individual capacity in the context of CRA can range from the capacity to write a policy that reflects potential adverse events, to the capacity to research and develop CRA practices, to the capacity to negotiate and resolve a conflict. The specific capacities needed depend on the role of the stakeholder and the threats to the food system.

Organisational or institutional capacity, seen through the 5C approach by Baser and Morgan (2008), is an organisation's capability to act and commit, deliver development objectives, adapt and self-renew, relate to external stakeholders, and achieve coherence (Babu and Blom, 2014). Each of the capabilities is required for organisations and institutions involved in CRA. Well-articulated CRA goals need to be set and pursued with commitment. Techniques and practices promoted through CRA programmes need to evolve constantly with the changing capacity needs of agricultural zones in which they are applied. This requires the engagement of all stakeholders. It is also important for organisations to commit to coherence in the achievement of objectives, to ensure that outcomes are achieved in the most efficient way.

Lastly, system capacity refers to the context in which changes are taking place (Baser and Morgan, 2008). In other words, through this dimension, we assess whether (and to what extent) the current conditions promote capacity strengthening for CRA. As in the case for Babu and Blom (2014), this includes the smooth functioning of different stages of the policy process (identification, research, strategy development, implementation, monitoring and evaluation, and strategy revision). However, for our purposes, we include larger systemic issues such as the existence of platforms for collaboration; media to synthesise efforts to mitigate climate change with other sectors; and an enabling social, political, and economic environment.

Country Examples

Although we need to build capacity at the individual, institutional, and system level, for the purpose of this paper, we will be focusing on building capacity at the institutional level. In the paragraphs below, we provide examples of CRA practices being applied in four countries (Bangladesh, Ghana, India, and Viet Nam) and their impacts. All four countries discussed in this study are agriculture-based economies with a majority of marginal, small, and medium-sized farmers; and are thus extremely vulnerable to climate change. Despite the continuous decline in agriculture as a percentage of gross domestic product (GDP), it still contributes a large portion of GDP for all four countries (World Bank, 2016). Notwithstanding similarities, the countries discussed are different with respect to their agriculture systems, cropping patterns, and policy processes.

Even with the increase in interest and awareness regarding CRA, the adoption of CRA intervention remains low in all four countries because of weak individual, organisational, and system level capacities (Babu and De Pinto, 2017). Capacity for conducting research, the adoption of innovation, and monitoring and evaluation for scaling up is crucial for making agriculture in developing countries climate-smart. Apart from human and institutional capacity gaps for climate-resilient agriculture (Babu and De Pinto, 2017), other factors such as poor understanding of climate-smart practices, limited awareness of technology's benefits, and lack of government support, decrease the rate at which CRA practices are being adopted and implemented.

Bangladesh

Bangladesh is primarily an agrarian country, with long coastlines, making it one of the most susceptible countries to climate change. In Bangladesh, Chapai Nawabgonj in the north-west is a drought-prone area (Ramamasy and Baas, 2007), Bagerhat in the south-west is a saline-prone coastal area (Miah et al., 2011) and Kurigram is flood-prone (Bose and Navera, 2017). Soil salinisation in river water and soil in south-west Bangladesh has increased over time and is aggravated by the increase in sea level caused by climate change (Dasgupta, 2017). In terms of employment, this sector provides livelihoods to about 60% of the population. Despite the formation of the Climate Change Cell (CCC) in 2004 under the Ministry of Environment, Forest and Climate Change, the adoption of CRA techniques and practices remains low. Bangladesh has developed plans and strategies to minimise the adverse impacts of climate change on agriculture and food security. The Bangladesh Climate Change Strategy and Action Plan, 2009 is the de facto policy document which provides strategic direction for work on climate change related issues.

CRA practices in Bangladesh include alternate wetting and drying (AWD), row cropping, the adoption of stress-tolerant and high-yielding seed varieties, urea deep placement, and aquaculture/floating agriculture. Excessive production of rice under irrigated conditions is the top contributor of GHG emissions, and the AWD technique can be used to limit emissions. AWD is a systematic management practice in rice production which involves periodic drying and reflooding of the field. This technique has been field tested and achieved positive results.

The yields of farmers using AWD increased by 9%–12% more than those of farmers using conventional irrigation, while water savings reached 22%–26% (De Pinto et al., 2017).

Even though AWD decreases GHG emissions and other environmental impacts, there are several constraints to scaling up AWD in Bangladesh. Institutional in nature, these include arrangements for water payments. This could be done by having a fixed seasonal rate or by paying a fixed share of the crop. Providing economic incentives for farmers to decrease the use of electricity and water can also help to reduce the carbon produced during agricultural production. However, there is a lack of willingness to promote AWD nationally. Other barriers to increasing AWD adoption include the lack of willingness of farmers to seek incentives, unlevelled farm fields, low awareness of the benefits of technology, and lack of government support (Basak, 2016; Lampayan et al., 2015).

Ghana

Even though sub-Saharan Africa does not contribute significantly to GHG emissions compared with other regions, adverse impacts of climate change are anticipated in this region, particularly in West African countries since they are heavily dependent on rain-fed agriculture. The impact of climate change on agriculture is manifested in four main ways: rising temperatures, declining rainfall totals and increased variability, rising sea levels, and high incidence of weather extremes and disasters. The distribution of rainfall is considered the single most important factor affecting agriculture in Ghana (Government of Ghana, 2010). Reduced and increasingly erratic rainfall in the country's ecological zones has adverse effects on the agricultural economy and livelihoods because agriculture in Ghana is largely rain-fed.

The CRA cocoa initiative in Ghana has focused on building support for climate-resilient agriculture interventions within the context of national REDD+ readiness activities. Agriculture is widely recognised as a major source of emissions. Using CRA practices can result in increased rural economic development and food security as well as climate adaptation and mitigation. The primary benefit to smallholder farmers who adopt climate-smart best practices will be a 50%–60% increase in yield and a potential annual revenue increase of $1,000 (Forest Trends, 2013).

Land use management practices have a significant impact on crop production in Ghana's ecological zones (Asuming-Brempong, 2010). Peterson (2014) conducted a household survey in villages of north-west Ghana to examine farmers' awareness of and willingness to adopt CRA practices. All the households surveyed were willing to adopt crop rotation, manure management, use of chemical fertilisers, and organic pest management. Ghana's Council for Scientific and Industrial Research introduced crop rotation as a technique to improve soil fertility and increase pest and disease resistance.

Despite these efforts, farmer adoption remains low because of limited awareness. Poor access to information regarding CRA practices and the limited capacity of Ghana's agriculture extension and advisory services to disseminate timely information are the key areas in which we need to strengthen capacity.

India

In the past 6 decades, Indian agriculture has undergone a major transformation. The country has moved from dependence on aid and food deficits to becoming a net exporter of food and maintaining an average growth rate of 3% (except for fiscal years 1997–2005). Despite this, food security remains a top priority for the agricultural sector because of the increasing population. In 2008, India took its first big step towards decreasing climate change risks by adopting the National Action Plan on Climate Change in 2008 (Government of India, Prime Minister's Council on Climate Change, 2008). The plan charts eight priority 'missions', one of which is the National Mission for Sustainable Agriculture. This lays down goals until 2017, but it does not clearly mention the steps required to achieve them. India is also a party to various international treaties such as the Paris Agreement, which came into force on 4 November 2016 (United Nations Framework Convention on Climate Change (UNFCCC), 2017; Patra and Babu, 2017).

Taneja et al. (2014) assessed farmers' preferences and willingness to pay for different smart interventions in India. The results of their study show that preferred interventions include laser land levelling (LLL), crop insurance, weather advisory services, direct seeding, zero tillage, and irrigation scheduling. The LLL technique has several impacts on climate change mitigation by reducing emissions through decreased pumping time, reduced cultivation time, and fertiliser savings (Gill, 2014). Farmers using the LLL technique saw a decrease in irrigation time of 45–55 hours per hectare (ha) for rice fields and 10–12 hours per ha for wheat fields (Aryal et al., 2015. An increase in yield of 340 kilograms/ha for rice farms and 320 kg/ha for wheat farms was also observed (Aryal et al., 2015; Gill, 2014).

Even though farmers expressed interest in adopting new technology that can decrease carbon emissions, large-scale adoption of such techniques requires access to funding (Taneja et al., 2014). Further, we need to build the capacity of the extension system to increase awareness amongst farmers regarding the positive impact of such technologies on yield and income.

Viet Nam

The Vietnamese government has taken various steps to combat the risks of climate change. While the focus has been on broader climate change issues, CRA is also given a lot of emphasis in current policies and programmes. Examples of policies that incorporate CRA techniques and practices include the Green Growth Strategy; the National Action Plan of Climate Change Adaptation; and the National Strategy for Natural Disaster Prevention, Response and Mitigation. As climate change could reverse the substantial economic progress made in agriculture in Viet Nam, the Ministry of Agriculture and Rural Development issued a decision in 2011 to promulgate an action plan for climate change with respect to the agriculture and rural development sector for 2011–2015. It has also implemented the Action Plan Framework for Adaptation to Climate Change in the Agriculture and Rural Development Sector for 2008–2020. At the international level, the Vietnamese government ratified the Paris Agreement and the Kyoto Protocol, by directing its agencies to lay down a legal foundation for preventing and mitigating natural disasters and coping with climate change.

AWD is a popular technique in Viet Nam since the country is a major rice producer. Along with limiting GHG emissions, AWD adopters in Viet Nam experienced a 20% decrease in production costs compared with conventional techniques (Quicho, 2013) and an increase in profit of 17–41% (Quicho, 2013; Ha, 2014), mainly because of the drop in irrigation and labour costs. Multiple studies reported a decrease in GHG emissions as a result of the adoption of AWD (Pandey et al., 2014; Narayan and Belova, 2014).

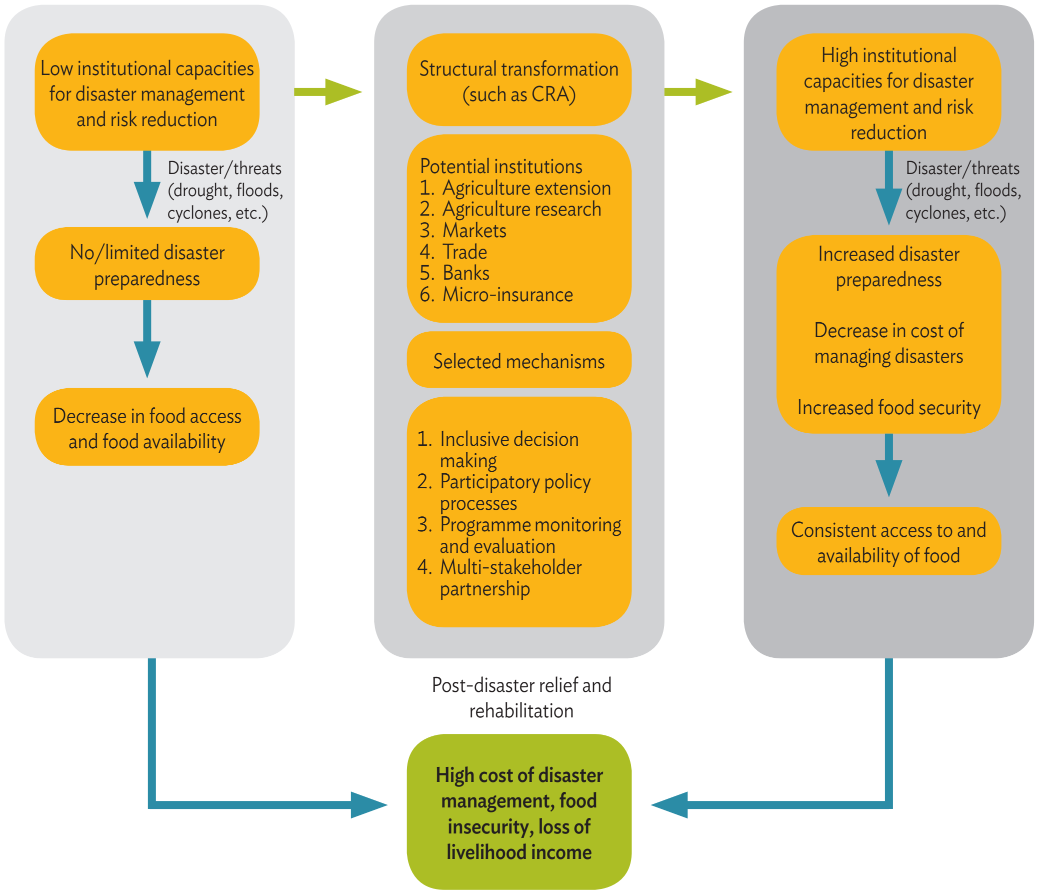
Viet Nam faces similar challenges to Bangladesh in promoting AWD amongst farmers. The payment of water remains a key challenge. Barriers to adoption are similar to those found in other countries where farmers pay for water from private pumps. Since incentives for AWD are directly linked to the irrigation system, capacity must be built for improved irrigation.

For example, the National Irrigation Administration in the Philippines developed and improved irrigation canals as part of a nationwide plan while local governments developed policies providing economic incentives for farmers to reduce water consumption.

10.3 Institutional Strengthening Framework for Disaster Management and Risk Reduction

From the country examples provided in the above section, we identify capacities needed at the institutional level to reduce the costs associated with natural disasters and mitigate risk. Institutional capacity includes elements such as effective leadership, human resources management, resource allocation, incentive structures that reward high-quality work, and a collaborative work environment. Using these examples, we have developed a consistent and user-friendly framework for strengthening institutional capacity for disaster management and risk reduction. The figure below shows the pathways through which institutional capacity can be built.

Figure 10.1: Strengthening Institutional Capacities for Disaster Management and Risk Reduction



CRA = climate-resilient agriculture.

Source: Adapted from Babu and Blom (2014).

Since farmers do not see a distinction between risk reduction and adaptation (FAO, 2013), scaling up CRA practices can help decrease threats to livelihoods and increase institutional capacity for disaster management and risk reduction. Institutions must be able to utilise the individual capacity of their employees effectively.

Developing countries face a number of issues and challenges in building adequate capacity for disaster management and risk reduction. In the context of climate-resilient agriculture, determining a country's optimal capacity for the design and adoption of CRA requires an understanding of how the system works. There are multiple pathways through which one can influence the system towards CRA: bringing forward policy issues and presenting data to demonstrate problems, conducting research to support evidence-based policymaking, and using media to influence politicians and constituents alike. Alternatively, more immediate small-scale change can occur at the community level by working with local governments, civil society organisations, and farmer-based organisations to design and implement CRA initiatives. Yet, without adequate capacity for designing and implementing effective programmes in farmers' fields, CRA innovation may remain on the shelves of laboratories.

Once the policies and programmes for CRA are in place, countries require efficient governance and institutional structures to sustain capacity development. Capacity, being a dynamic concept, needs institutions that can constantly adapt to changing circumstances and technological developments. Similarly, accountability and transparency (clarity in roles and functions) in the functioning of institutions and key actors is required at the national, regional, and local levels. This is important in sustaining programmes not just financially, but also in terms of their credibility. Additionally, avenues for coordination and collaboration are an essential component of this element in avoiding the duplication of efforts.

Investing financial and human capital in information monitoring and knowledge management systems is a tested way of building institutional capacity. This is important for using resources effectively and efficiently. For instance, the development of reliable methods of measuring, monitoring, and accounting for emissions across various agroecological zones is important to assess the progress of CRA programmes. That would help inform decisions regarding resource allocation for future such reforms. In a world of trade-offs, regular and reliable monitoring is the only way to guide informed resource allocation.

Since development in techniques for CRA rests on technological development and innovation, building institutional capacity for research, testing, and dissemination of this information (through agriculture extension) is crucial. This includes inputs used by farmers in the field; inputs needed by researchers to conduct their studies; and technical support needed by policymakers to formulate, implement, and monitor CRA programmes.

10.4 Conclusion

To mitigate the risk associated with disasters, a holistic approach comprising elements of prevention, mitigation, and response is needed. Along with post-disaster relief and rehabilitation, it is important to consider disaster management and risk reduction comprehensively. The frequency of natural disasters has increased globally (ADB, 2013); and the Asia-Pacific region is projected to be the most affected by the impacts of climate change such as floods, drought, and cyclones (Davies et al., 2008). Developing countries are especially vulnerable to such disasters and are often the least capable of coping with the associated impacts because of their limited adaptive capacity (Davies et al., 2008). Therefore, it is necessary to build capacity at the individual, institutional, and system levels for disaster management and risk reduction to decrease the overall impact of natural disasters and costs associated with post-disaster relief.

Although it is important to build capacity at all three levels, building institutional capacity is crucial since it remains a challenge for many developing countries. While several approaches to build institutional capacity exist, this paper focuses on building institutional capacity for disaster management and risk reduction through the agricultural sector. Climate-resilient agriculture has become an effective tool for adapting to climate change and developing resilience in the long run – resulting in increased capacity for disaster management and risk reduction.

In this chapter, we identified technologies and practices adopted by farmers from Bangladesh, Ghana, India, and Viet Nam. From the country examples provided, we identified the capacities needed at the institutional level in order to reduce the costs associated with natural disasters and mitigate risk. Using this information, we developed a framework which can be applied to strengthen institutional capacity for disaster management and risk reduction. For the purpose of this chapter, we focused on strengthening capacity for building the resilience of the agriculture sector to climate change and variability as an example. However, this framework can be applied to different sectors to build institutional capacity such as an early warning system.

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