Chapter 3

Addressing Disaster Risk, Climate Change, and Food Security through Successful Structural and Non-Structural Measures in Country Adaptation Roadmaps

Meinhard Breiling

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CHAPTER 3

Addressing Disaster Risk, Climate Change, and Food Security Through Successful Structural and Non-Structural Measures in Country Adaptation Roadmaps

Meinhard Breiling
TTL Interfaculty Cooperation Centre
Technische Universität Wien, Austria

ABSTRACT

The aim of this chapter is to support the development of adaptation roadmaps for Association of Southeast Asian Nations (ASEAN) countries and to address three challenges—disaster risk reduction, climate change adaptation, and food security—simultaneously. The discussion distinguishes amongst structural, non-structural, control, and improvement measures, and provides examples of these measures from Austria, the rest of Europe, and other parts of the world. Finally, a sample adaptation roadmap for ASEAN countries targeted to 2030 is proposed.

3.1 Introduction

Disaster resilience, adaptation to climate change, and food security can be achieved through a combination of planning and measures. By combining separate plans or legal frameworks for disaster resilience, food security, and climate change adaptation (CCA), it is possible to establish national frameworks that are more than just the sum of all three separate approaches. The aim is to decrease vulnerabilities and increase resilience to all three threats simultaneously. Vulnerabilities vary due to environmental properties, risk exposure, landscape features, population pressures, and the educational background of the concerned people, amongst other factors. Resilience is the ability to cope with threats and relates to the endogenous power of people from within the region. This depends widely based on their wealth or disposable income as well as their power to organise relief from within the region.

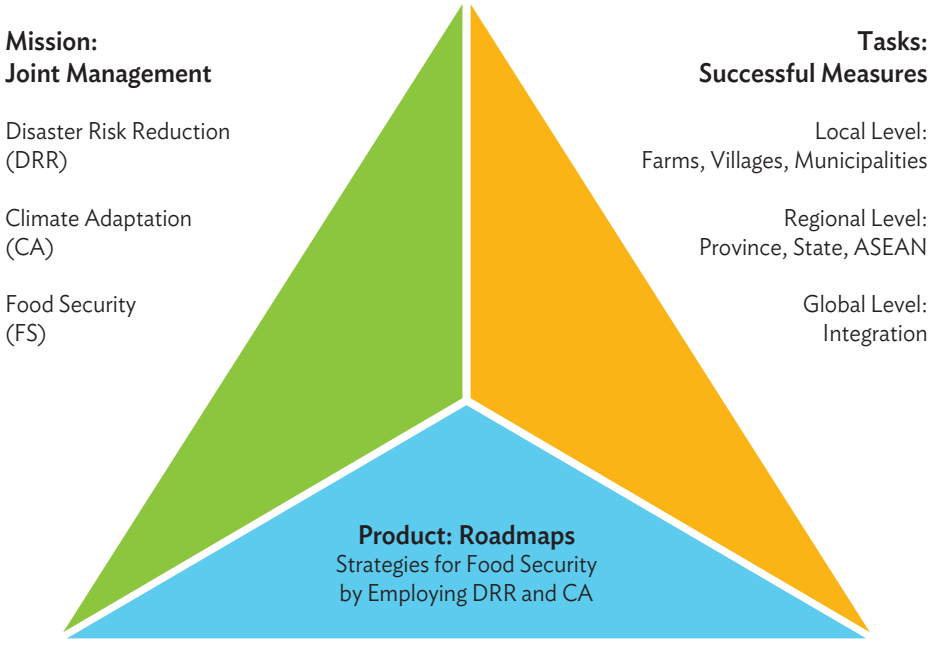
Climate change and the consequences of disasters are costly. The Stern report (Stern, 2006) argued that if countries fail to act, the overall costs and risks of climate change will be equivalent to losing at least 5% of global gross domestic product (GDP) each year. If a wider range of risks and impacts is taken into account, damage estimates could rise to 20% of GDP or more. As such, climate change and the increased frequency of disasters will become a hindrance to development. This contrasts with the successful economic growth thus far in Association of Southeast Asian Nations (ASEAN) countries that has led to increased wealth and food security. During 2007–2015, the average annual real growth rate was 5.3% collectively for all countries (ASEAN, 2017). Hunger is no longer a major threat in ASEAN. In 1992, hunger reached levels that were serious in the Philippines and Thailand; alarming in Cambodia, Viet Nam, and Indonesia; and extremely alarming in Myanmar and the Lao People's Democratic Republic (Lao PDR). As of 2017, hunger was still a serious problem in Cambodia, Indonesia, the Lao PDR, Myanmar, and the Philippines (Welthungerhilfe et al., 2017); however, if the industrialisation of agriculture and food production continues at the same rate as in the last 25 years, hunger in the region is expected to disappear.

Although ASEAN countries are experiencing opposing trends, they currently have an opportunity to take more control over environmental decline and safeguard economic growth at the same time. Financial reserves and good infrastructure are crucial to achieve food security and eradicate hunger in an era facing ever more frequent and major disasters and damage. More structural and non-structural measures on local or regional food production and food consumption scales are required to reduce vulnerabilities and boost the resilience of ecosystems. Countries need to expand physical infrastructure such as storage facilities to minimise food loss after harvests and roads to accelerate food transportation systems, while supporting ecosystems with green infrastructure to cope with increased levels of environmental stress of all kinds. Countries should also safeguard an enlargement in institutional capacities and enhance the efficiency of public administration while implementing public awareness measures and encouraging broad business involvement. Many targeted measures will be required to oppose a possible reverse of the success observed in the area of food security.

For this reason, ASEAN countries will produce adaptation roadmaps to implement joint measures of disaster risk reduction (DRR), CCA, and food security, with the aim of uniting these three separate frameworks into a common framework. The task is to identify successful structural and non-structural measures and collect advice as to how far these measures can be optimised and controlled.

Prompting the broad involvement of government officials, extension offices, and learning institutes will guarantee broader and more targeted participation by businesses involved in agricultural production and food processing and by the public. It is also necessary to outline the necessary steps and timing for the implementation of the measures. Economic considerations to reduce costs and avoid duplication by independent teams working on separate plans are a key concern here. Figure 3.1 describes the mission, tasks, and product outcome of this process. This chapter draws from an Economic Research Institute for ASEAN and East Asia (ERIA) workshop held in Singapore on 25–26 May 2018, that involved government officials and experts from the ASEAN region (ERIA, 2018).

Figure 3.1: Process of Designing Country Adaptation Roadmaps in the Association of Southeast Asian Nations



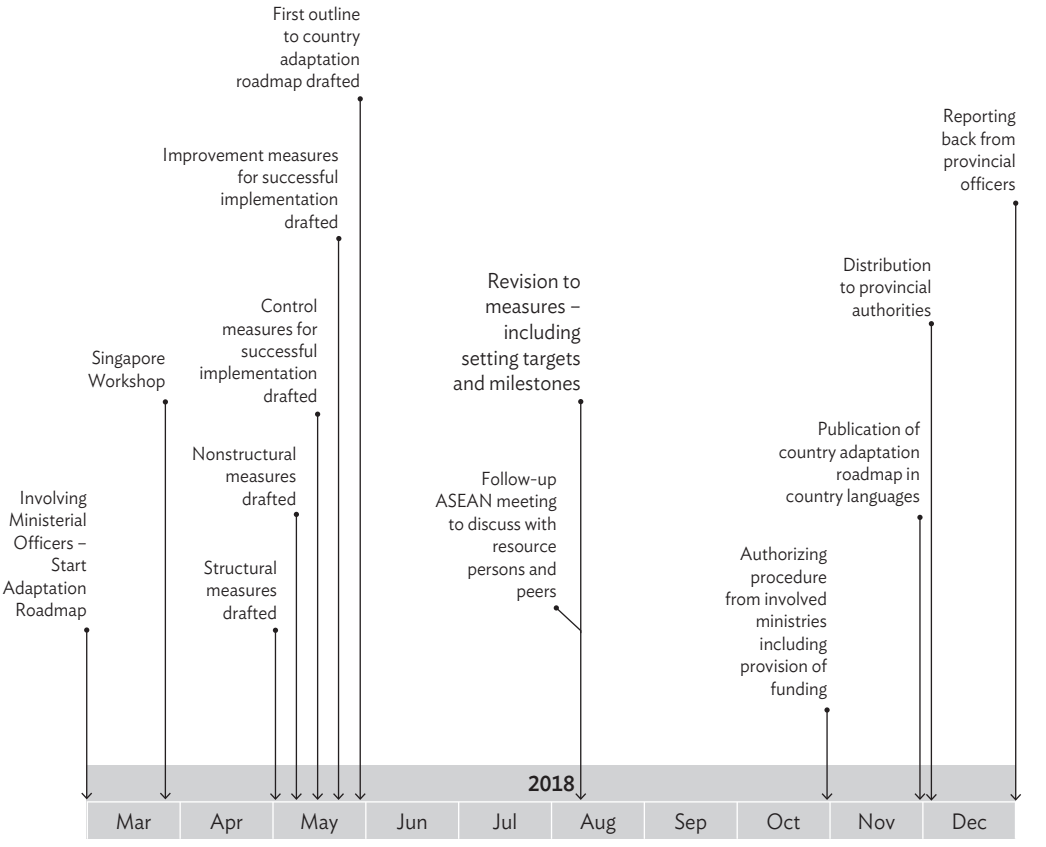
ASEAN = Association of Southeast Asian Nations.

Source: Economic Research Institute for ASEAN and East Asia (2018), Memorandum of the CCA Roadmap Workshop on Evaluating the Distributional Impacts of Disasters and Climate Change. Singapore. 25–26 March 2018.

There is a close space–time relationship connecting planning at the regional (ASEAN) level, at the national level for each of the 10 member states, and at the local level for the many individual areas in the ASEAN region. The roadmaps encompass immediate or short-term local measures and decision making, as well as long-term national policies, and shall provide a timeline as to how and when these measures are planned to be implemented. The declared interests of food security, DRR, and CCA can be formulated as territorial or sector plans and regulations for agriculture, the food industry, retailers, or consumer protection and health standards.

Ideally, a national adaptation roadmap will be embedded in an ASEAN region adaptation plan, and will consist of several smaller subregional or provincial adaptation plans highlighting particular disaster risks and climate threats. This makes it possible to recommend more specific measures to counter disaster threats. In dealing with the 'scaling issue,' that is, selecting the local or regional area of concern, it is very important to judge whether the issue is an immediate threat to local people or will be a longer-term regional problem in the future. To assess this, the 'local' scale can be broken down further into the farm (or firm), village, and municipal scales (with each larger scale comprising the smaller ones). Similarly, the 'regional' scale can be broken down into the province, nation, and ASEAN as a whole. It can be challenging and demanding to transition smoothly from the national scale down to the appropriate local scale, and remote, sparsely populated locations in particular are often considered to be largely unimportant to regional decision making. Subsistence agriculture and limited or nonexistent value chains prevail in such areas. Damage caused by disasters to traditional agricultural systems can be managed on this scale if local societies remain vital. However, remote areas are endangered even in the absence of disasters as young people in particular emigrate to find higher incomes and a better education for their children. No reactions at the local scale despite initially low values at risk are likely to accumulate over time to become a larger regional problem. Therefore, it is best to solve local challenges immediately to achieve higher regional resilience as a result. If all ASEAN countries can reach a significant number of stakeholders at ever smaller scales, the region will be able to achieve a combination of high disaster resilience, effective protection from climate change, and an optimal level of food security. This will simultaneously address the aims of international frameworks like the Sustainable Development Goals 2030 (United Nations [UN], 2015), the Paris Accord (UN Framework Convention on Climate Change, 2015), and the Sendai Framework for Action (UN, 2015); and will contribute further to overall global sustainability.

Figure 3.2: Timeline of Designing Country Adaptation Roadmaps in the Association of Southeast Asian Nations



ASEAN = Association of Southeast Asian Nations.

Source: Author.

The process of establishing DRR, CCA, and food security country adaptation roadmaps depicted in Figure 3.2 differs from the final country adaptation roadmap presented at the end of this article (Figure 3.5). The establishing process is an urgent issue that must be completed within 2019. The process involves key decision makers from ASEAN government institutes and resource persons from scientific research institutes and universities under the initiative of ERIA (2018). It is assumed that a small, efficient team can initiate a much broader implementation process of the final product, a national country adaptation roadmap.

The actual roadmap has a much longer medium- or long-term time horizon, being targeted toward 2030. The adaptation roadmap should mark validity and responsibilities for a given territory or sub-territory, and demarcate the locations, timelines, and interests to be considered at the beginning. The plan must determine deadlines for reaching certain goals, assign responsibilities for actions (in light of the fact that the venture has many stakeholders), and set realistic milestones. Urgent projects require consideration, reactions, or measures within a year. The 'short term' may be considered within a slightly longer perspective (2–3 years), while 'medium term' generally involves a 5-year horizon but can extend to a maximum of 10 years. Long-term planning relates to actions that require more than a decade to implement. It might also be necessary to revise the adaptation roadmap after several years. A revision every 6–7 years should be targeted, a timeframe similar to that used in the European Union (EU) budget or the update frequency of Intergovernmental Panel on Climate Change reports. Long-term planning visions may be valid for twice as long.

Below we discuss four categories of measures for establishing national adaptation roadmaps: structural measures, non-structural measures, control measures, and the improvement of established adaptation measures. This discussion is based in part on discussions held during the 2018 ERIA workshop in Singapore, an analysis of similar government documents from outside the ASEAN region, and the findings of scientific papers.

3.2 Structural Measures

Structural measures are primarily local measures and refer to any physical construction to reduce and avoid the possible impacts of hazards, or the application of engineering techniques to achieve hazard resistance and resilience in system structures. Some examples include dams, flood levees, ocean-wave barriers, earthquake-resistant construction, and evacuation shelters. Technical measures generally include substantial investments and regional financing, and therefore go beyond the local scale and require intensive cooperation between local and regional stakeholders. Only very important places from a value chain perspective—such as densely populated urban areas, traffic nodes, or hubs—will receive the funding required to realise such projects. Less important places from a value chain perspective (usually less populated and rural areas) must implement inexpensive structural measures to improve the resilience of their environment.

A good example of rather inexpensive structural measures is green infrastructure. Green infrastructure is based on the principle that 'protecting and enhancing nature and natural processes are consciously integrated into physical planning and territorial development' (European Union, 2013). It requires significantly less investment than other structural measures. In Europe, several regions, cities, and rural areas are promoting strategies defining green infrastructure as 'a strategically planned network of natural and semi-natural areas with other environmental features designed and managed to deliver a wide range of ecosystem services' in both rural and urban settings (European Environment Agency, 2015). Green infrastructure plays a key role in achieving a variety of interconnected environmental areas such as biodiversity conservation, territorial development and cohesion, climate change mitigation and adaptation, agriculture, and forestry management. In the following section we recommend specific structural measures based on green infrastructure, as they contribute best to achieving the desired combination of DRR, CCA, and food security in the targeted ASEAN country roadmaps. In particular, we highlight several feasible methods—the provision of agricultural land for the urban poor, urban gardening, agro-forestry, alleys and hedges, increased organic content in soil, traditional water management for rice cultivation, and wetland restoration—that can enhance the desired ecosystem service performance with limited investments.

Disasters that affect cities and urban areas cause particularly extensive damage. The resilience of urban and metropolitan areas to disasters can be increased considerably by planning garden villages—consisting of a mosaic of small gardens—during early stages of development when public land is still available or can be bought at modest prices. For example, Graz, the second largest city in Austria, is implementing a roadmap called 'Smart Food Grid Graz' in an attempt to double local food production (within a diameter of 30 square kilometres) from its current level of less than 15% to 30% in 2030 (Seebacher et al., 2017). An extended green area with many small private gardens is considered to fall under the umbrella of climate mitigation and abatement, as the food is not transported and greenhouse gas emissions are negligible, while the dense net of green infrastructure offers protection from extreme rain and storms. In addition, run-off water stays in the green infrastructure and does not run directly into urban canals.

Green infrastructure in cities will substantially limit damage from disasters. Municipal and local governments should consider buying or arranging land areas for urban green belts (Amati, 2008) or green nets with small plots of agricultural land for gardening and food production. This land should provide a food reserve for the urban poor and can be

leased out for limited periods and at moderate prices. At the same time, the connected green nets and/or rings will serve as a protective measure in the case of extreme disaster events. Vienna, the Austrian capital, offers a successful example of providing such opportunities for urban dwellers (Vienna Municipality, 2013). When refugees returned to the city after the First World War, 100 years ago, the country was seriously damaged with no financial reserves, and people's employment and activity options were limited. However, as there were land reserves available, the city bought some extra land and allotted it to eligible people with a low income and no property in the town. These citizens used the plots to cultivate fruit and vegetables, considerably reducing living costs. As the plots were small, and impossible to sell or speculate with (since they were not owned by the occupants), dozens of urban garden conglomerates with their holders organised into small garden associations known as *Kleingartenverein*, which helped contribute to a very high quality of life considering the comparably modest consumption of resources. Even today, some of the food consumed by the public comes directly from these plots. Initially, only cottages, not houses, could be established on such plots; however, 30 years ago, the municipal government permitted holders to build small houses not exceeding 50 square metres (m^2) on these plots. Although the gardens are relatively small (200 m^2–600 m^2) and do not include room for parking cars, they can contribute to food security in periods of crisis as was continuously the case during the wars.

Urban gardening is not restricted to small garden associations, but is also found in contemporary forms. The municipality of Vienna owns one of the largest organic farms in Austria. Its ecological performance is its most important function and, as all workers are employed by the city, the economic pressure of farming is largely reduced. In addition, several research projects on organic farming are carried out here. At several new housing projects currently planned in Vienna, new settlers can rent small garden plots 20 m^2–60 m^2 in size for approximately €100 per year in adjacent areas. A contract farmer prepares the land according to organic principles each spring with his machinery and arranges plots for urban gardeners. In some cases, a set of common vegetables is already planted. The urban plot holder simply plants and cares for the desired crops, vegetables, and fruits during the growing period. After the harvest, the contract farmer will prepare the land for the next growing season (Selbsternte, 2018). Another form of urban gardening is so called guerilla gardening where inhabitants use public plots for gardening. While this is not necessarily legal, municipalities sometimes do not mind their citizens actively greening underused urban plots (Howard, 2014).

Agro-forestry is a method of land management involving the simultaneous cultivation of farm crops and trees. Agro-forestry ensures a continuous food supply and some continuous economic returns, avoids soil degradation, offers higher resistance against storms and floods, and accordingly lessens damage from disaster events. However, they require a high level of manual work by the farmers in exchange for the avoided investment, and will be challenged if income levels in ASEAN countries increase, enticing young farmers to look for better income opportunities outside agriculture. Systems that have been working properly can continue for some decades due to the input of labour by the elder generation; however, as farmers increasingly lack time to work on agro-forestry farms, the performance of these systems can deteriorate.

Alleys and hedges along roads can protect rural transportation routes in particular from wind and extreme weather. They also hold back and store rainwater in their leaves, allow the infiltration of rainwater, and retain excess water with their roots. In addition, these elements provide shade for pedestrians and animals in temperate local climates.

Increasing the organic content of soils will make them more productive and resilient to soil erosion and disaster impacts. Green manure and animal waste can be used to boost the organic content of soil. Another way to increase the organic content of soil artificially is to breed earthworms and apply them on fields. In Austria and the rest of Europe, certain companies are selling earthworms to improve soil (Vermigrand, 2018).

Water ponds and channels for rice fields that are built from natural materials must be well maintained to keep or enhance their protective function against increased disasters. As the number of young people declines in many areas, many local irrigation systems cannot be maintained and will lose their protective function in the near future. The renovation of traditional systems and their protective function are still working well in a few cases, such as the rice terraces in Bali (United Nations Educational, Scientific and Cultural Organization, 2018), and landscape maintenance is also financially rewarded through tourism. However, in many other places where tourism is not as pronounced as in Bali, financial resources to renew such traditional systems are lacking.

The creation of more wetlands and additional forest areas offers good protection against floods. Wetlands act as sponges that soak up moisture, and wooded areas can slow water loss when rivers overflow. These areas are often destroyed to make room for agriculture and development. Halting deforestation and wetland drainage, reforesting upstream areas,

and restoring damaged wetlands could significantly reduce the impact of climate change and extreme weather events. Groups in ASEAN are already actively pursuing this aim. The Indonesian Peatland Restoration Agency is implementing government plans and actions to restore 2.4 million hectares of peatland by 2020 (Wetlands International, 2017). Avoiding shifting cultivation and the burning of forest land is another means of increasing resilience to DRR and CCA.

Another action area is the construction of storage facilities. Modified climate patterns are creating a higher degree of uncertainty surrounding what was considered reliable in the past. Water storage facilities built to collect rainwater can help overcome dry periods by providing additional irrigation water. Small-scale harvest and conservation silos are particularly valuable in remote rural areas with poor distribution systems, and can reduce food insecurity substantially (Yusuf and He, 2011).

Smart farming methods and plant factories are using advanced technology in agriculture and are producing an increasing amount of data (Wolfert, Verdouw, and Bogaardt, 2017). In urban areas in particular, ever larger amounts of food like tomatoes, cucumbers, paprika, and other vegetables are being produced in partly or completely artificial environments. They use limited space and can produce at world market prices, but depend economically on cheap long-term contracts with energy supply companies, and require high initial investments. Plant factories produce certain vegetables in closed chambers under a controlled environment. All in all, the old and new methods of urban farming both considerably reduce vulnerability to disasters by providing a buffer against their adverse effects.

Smart-farming methods in rural areas use sensors that detect characteristics in weather patterns and warn farmers of unfavourable weather conditions. Although these kinds of technologies are currently too expensive to be used broadly, they contribute to new knowledge and allow for easier adjustment to unwelcome or extreme weather phenomena. Over the next few decades, these technologies will advance even more and become much cheaper.

The transfer and use of inadequate, unsustainable, or unsafe technologies for adaptation must be avoided. Technology recipients should be able to identify and select ‘sustainable technologies’—i.e. those that are climate-smart, economically viable, and socially acceptable—appropriate to their actual needs, circumstances, and capacities.

Some approaches to coastal protection have proven inadequate, for example when the weight of rocks making up a breakwater is insufficient relative to the energy of the significant wave. Sea walls often accelerate erosion for adjacent, unprotected areas of the coast, and seawater can breach coasts near aquifers and limit possibilities for agriculture. The use of coastal mangrove forests for lobster breeding was perceived to be a particularly bad practice for both the environment and workers (Environmental Justice Foundation, 2013), and the EU banned shrimp imports from Thailand in 2014 due in part to bad environmental practices. However, in recent years initiatives have begun to afforest mangrove forests (Villadiego, 2016).

There are unfortunately several negative examples of environmental impacts, such as the depletion of groundwater resources to produce low-priced agricultural products, instead of conserving this resource. Salinisation and seawater intrusion present a particular problem; when formerly suitable agricultural land is salinised it becomes more vulnerable to heat and flood disasters, as less water can infiltrate the soil and the soil in turn cannot hold this water. For example, case studies from the Republic of Korea indicate that a combination of pig manure and seawater intrusion in the volcanic island of Jeju have widely limited resource values and potential for further economic development (Kim et al., 2003). Another case from China (Han et al., 2014) identifies saltwater intrusion as a consequence of brine extraction that began in the 1990s. New and more intensive uses of resources combined with an increase in the frequency and scale of climate-related disasters widely decreases the resilience of areas and calls for counteractions.

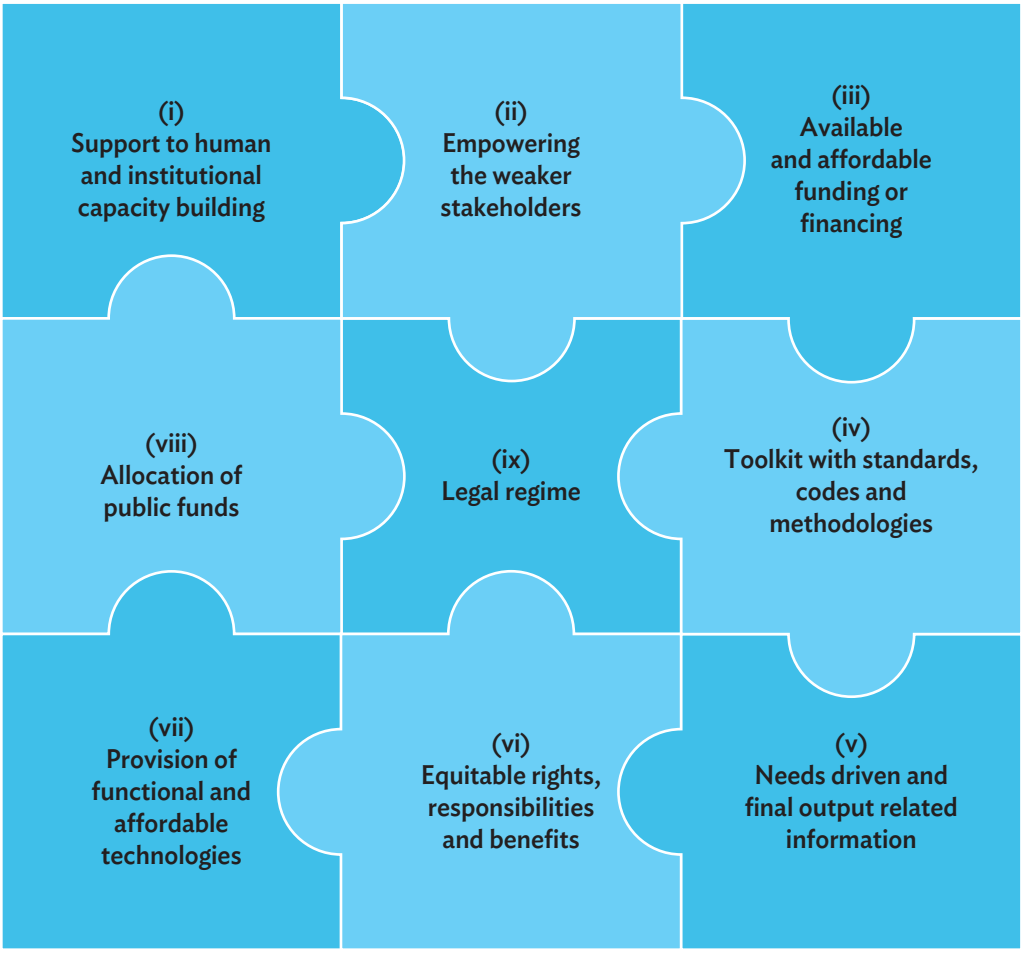
3.3 Non-Structural Measures

Non-structural measures are those that use knowledge, practice, or agreement to reduce risks and impacts, in particular through policies and laws, awareness creation, disaster preparedness training and education, the compilation of data and research, land use planning, and insurance.

Adaptation roadmaps reach many stakeholders at the practical, applied level. They aim to create and strengthen an enabling environment for adaptation, and to integrate adaptation planning and implementation into new and existing development policies, plans, frameworks, and practical actions. This includes the following requirements (see Figure 3.3): (i) support human and institutional capacity building; (ii) empower weaker stakeholders in

particular and give them a voice in the mainstreaming process; (iii) identify available and affordable funding or financing for benign actions; (iv) collect a toolkit with relevant and applicable standards, codes, and methodologies; (v) provide needs-driven and final output-related information; (vi) allocate equitable rights, responsibilities, and benefits; (vii) provide functional and affordable technologies; (viii) allocate public funds along with favourable macroeconomic conditions; and (ix) stipulate robust and responsive legal regimes.

Figure 3.3: Diagram of Requirements for Successful Adaptation Roadmaps



Source: Economic Research Institute for ASEAN and East Asia (2018), Memorandum of the CCA Roadmap Workshop on Evaluating the Distributional Impacts of Disasters and Climate Change. Singapore. 25–26 March 2018.

It is essential to document major risks to the economy and society from disaster events and climate variability. It is also necessary to characterise the probability of these events occurring with respect to location, time, and the associated social and ecological consequences concerning prevailing economic interests.

Regions (e.g. nations or provinces) must analyse the extent to which their food security has been challenged in recent decades (at least twice as far back as the prognosis horizon); for example, if a country is looking to assess the situation in the next 10 years, it should take the past 20 years into consideration. In particular, countries should consider the frequency of droughts, floods, cyclones, extreme temperature events, and shifts in regular or usual weather patterns (e.g. changes in the arrival of monsoons) during this period; the (prize) effects on the supply of the most important agricultural inputs like energy, fertiliser, pesticides, and agricultural machinery; and damage and loss impacts, if any, on pre-harvest, harvest, and post-harvest processes. The analysis should describe the economic challenges faced by the food processing industry and retail chains by quantifying damage and loss due to different kinds of disasters, as well as consumer difficulties such as electricity failures related to disasters and consequent damage to food (such as the unintentional thawing of frozen food). All conceivable damage in the context of food production can be quantified and put into perspective based on the general income level of the area. The smaller the chosen local area, the greater the deviation from the regional or global average may be. Therefore, the impact and related cost of disasters, even if limited in scale in general, are likely to be less in larger areas and especially high in small areas directly affected by the disaster. Another difference in impact can be seen if a disaster hits a highly urbanised area or a lightly populated rural area. Agricultural production is relatively more important in remote areas that lack other income sources, and poor, less developed countries depend economically much more on agriculture. The United Nations Food and Agriculture Organization (FAO) found that agriculture-related damage from disasters is particularly extensive, reaching 25% of agricultural production value (FAO, 2015).

The motivations driving various stakeholders to engage in the adaptation process, and to replicate these motivations in other players are supported by specific schemes. EU programmes and the region's common agricultural policy are an important motivation for DRR and CCA. These are ecologically minded, primarily voluntary programmes to make the local resource base more resilient. An investigation of wine farming communities in Austria found that farmers were primarily motivated to participate in such programmes by economic incentives (Kieninger et al., 2018). Similar experiences were recorded for other agricultural commodities and other countries in Europe.

Land use planning is a key component. For example, it is crucial to create water retention areas to minimise flood damage. Local and regional hazard maps have to be citable at various scales to understand the risks to the population concerned. With regard to flood and avalanche disasters, each district in Austria has produced a hazard zone plan that forecasts catastrophic risks by demarcating red zones that indicate the likelihood of the appearance of a 150-year disaster event and yellow zones indicating the regular occurrence of extreme events causing severe damage in certain years (Federal Ministry of Sustainability and Tourism, 2018).

Education is key to abate successfully an increasing number of disasters that are causing ever more damage per event, on average. It is also necessary to build the willingness and ability of communities to adapt continuously to new circumstances and challenges, and to realise an increased potential for risk abatement. High levels of awareness, motivation, and empowerment within the public and private sectors and in civil society will help people, communities, and the wider society adapt in this way. However, this requires a long-term approach to developing and delivering comprehensive and targeted awareness-raising and educational programmes. Education was identified as key to decrease the vulnerability of various countries with regard to different kinds of natural disasters (Muttarak and Lutz, 2014). Two case studies from Thailand confirm this. During the droughts and floods of 2010, the educational attainment of rural villages played an important role in reducing economic vulnerability (Garbero and Muttarak, 2013); similarly, during the Indian Ocean earthquake of 2012, villages where more individuals and households had a higher level of educational attainment were better prepared for earthquakes and disasters. The study also found that villages where a large percentage of women had a secondary education were more resilient than those villages where women only had a primary education (Muttarak and Potisiri, 2013). Although education is a long process, the higher the educational level of the resident population, the more awareness, motivation, and empowerment can be expected in both the public and private sectors and in civil society. In addition to normal schooling and university courses, specific educational programmes for adults and the elderly should be considered.

The present reluctance of banks and other lending institutions to finance adaptation and resilience activities due to the perception that they involve longer term, high-risk projects should be addressed. This barrier can be reduced by promoting institutions, arrangements, and mechanisms that can provide innovative financing, including microfinance, crop insurance, green finance, secured loans, leasing arrangements, and public–private partnerships, thereby allowing adaptation to proceed without government intervention. Insuring against climate risks has become a rather controversial issue in Austria as private

farmers are partly insured against climate risks through public financing (Sinabel, 2017). A premium support can be a hidden subsidy to the insurance company and might not reflect the objective level of risk. These programmes must also accord with disaster relief programmes and the national disaster relief fund.

An interesting example of avoided deforestation and therefore DRR and CCA is the so-called Rainforest of the Austrians, where 40 square kilometres of land were bought and enlarged through private microfinancing and individual sponsorship in Costa Rica (Regenwald der Österreicher, 2018). Here we see an NGO that understands the cultures and background of two diverse countries acting as a mediator between the countries. Another kind of funding targets public–private partnerships, and a national fund provides a certain amount to support climate-benign projects each year. In Austria, government agencies commission certain institutions to support and evaluate climate-benign projects, with benignity a precondition to obtaining public funding (Kommunal Kredit Public Consulting, 2018). Projects within the country are primarily supported with goal of defraying costs that exceed the cheapest variant in relation to the climate-benign design. In some cases, projects outside Austria, especially in least developed countries, can be supported to compensate for carbon dioxide emissions in the country.

Another possibility for DRR and CCA are targeted programmes similar to those developed in the EU. These programmes generally need an additional 5%–15% of public cofinancing from local governments. They are often designed for disfavoured regions or locations with considerably less per capita income than the average within the EU. Other variants of the programme are prepared for businesses that can count on public support if they follow certain rules.

The EU and its member states have developed several programmatic approaches founded in EU directives that cover the entire territory of the EU and are often overtaken by neighbouring countries. For example, the EU Water Framework Directive was enforced in 2000 (EU, 2000), and the EU Flood Directive of 2008 was introduced as an addition to this document. Some challenges regarding the mapping of flood risk areas and intergovernmental exchange between ministries were described (Alphen et al., 2009). Previously established directives relevant to farming include the Habitats Directive (1992) and Nitrates Directive (1991). Efforts to establish a comprehensive soil directive in the past decade were not realised. In 2016, the EU Directorate published an action plan on the Sendai Framework for Disaster Risk Reduction 2015–2030 (EU, 2016).

Successful adaptation to climate variability and disasters requires programmatic approaches that provide institutional and operational support for individual projects. A sound economic analysis will help minimise the limitations resulting from the short-term and narrow nature of projects. Reducing administrative and related burdens will provide much more control over the direction taken by individual projects. These approaches also increase the possibility of sustaining the benefits of a project, even after funding has ceased, and expedites the proposal development and approval processes, as well as implementation.

3.4 Control Measures

The enabling environment for adaptation roadmaps must be enhanced, the legislation and regulations that facilitate DRR and CCA made more powerful, and the capabilities of relevant regulatory agencies improved. It is also necessary to implement compliance monitoring (including naming the relevant agencies or bodies in charge), and strengthen enforcement capabilities. Policymaking, planning practices, and industrial development activities should ensure that all future generations are able to enjoy every important aspect of life, including peace and security, a healthy environment, a low risk of preventable catastrophes, conservation of knowledge, stable governance, a good life for children, livelihood opportunities, gender equity, and justice.

Ensuring macroeconomic conditions that favour successful adaptation activities include those that foster economic transparency. Such conditions are needed to ensure that disaster and climate-related risks are not masked or compensated for by hidden subsidies and thereby transferred to the wrong parties. The involvement of the private sector (e.g. investors and other players in the finance sector) in adaptation will be encouraged by macroeconomic conditions such as low inflation, stable and realistic exchange and interest rates, pricing that reflects the true marginal and fully internalised costs of materials, energy, labour and other inputs; deregulation; the free movement of capital; operation of competitive markets; open trade policies; trade facilitation; and transparent foreign investment policies.

A particular problem influencing food insecurity in remote rural areas is the absence of markets or the difficulty of accessing markets. Even when harvests are good, excess produce often cannot be sold due to a lack of transportation infrastructure, political conflicts, or, in the worst case scenario, civil wars, while bad harvests rapidly lead to emergency situations.

A lack of trade communications imposed by natural or manmade disasters is a major hindrance to development. If more central zones or entire countries or regions are affected by an adverse development, this will lead to inflation, high interest rates, black markets for food commodities, no investments, and a lack of resources, such as energy to operate agricultural machinery.

Corruption is a serious threat to economic transparency. Structural DRR and CCA measures in particular can be used to mask illegal transfers. The World Bank has developed a country policy and institutional assessment indicator (based on 20 criteria; made accessible via their website) that assesses the overall economic policy and related institutions of a country (World Bank, 2018).

Emphasis must be placed on coordinating activities—e.g. taking advantage of synergies, minimising duplication, and avoiding redundancies—to complement other development efforts. Priority should be given to adaptation activities that deliver tangible and visible benefits, rather than on exploratory studies, that is, activities that deliver outputs and outcomes whose relevance and value is at least equal to that of those provided by mainline ministries. This can help offset the fact that climate change is often perceived as a longer term issue, while other challenges, including disaster recovery, food security, human settlement, infrastructure, water supply, sanitation, education, and health care, require more immediate attention.

Mediators are needed to explain the interdependence between DRR, CCA, and food security. Ministerial officers can do this job on inter-ministerial boards, while special advisors and agricultural extension officers can raise awareness amongst stakeholders. Large industries in particular need to understand their role in contributing solutions for problems. In addition, the public needs to have the opportunity to understand the complexity and interdependence of joint implementation. Many people in ASEAN countries are now aware that the climate has changed. For example, if heavy rainfall disturbs the dry season, small-scale producers feel the impact. During a study tour of Bali in July 2016, farmers reported that 70% of the value of the dry-season harvest had been ruined by heavy rainfall. Fungi had affected the onions and coffee beans, and smallholder farmers lost important parts of their income. What was lacking was a climate-related communication offering advice as to how to protect a larger share of the harvest.

A good example of regular information on and explanations of CCA and DRR is the Yale Climate Connections group, which consists of academics who make sometimes complex information easier to understand (Yale Climate Connections, 2018). They produce several articles a week to supply an interested public with up-to-date information on climate issues.

A commitment should be made to the ongoing practice of monitoring, reviewing, and strengthening the Sustainable Development Goals (SDG) 2030 targets and their inter-linkages with DRR, climate change, and food security. Monitoring and reporting methods should emphasise transparency, consistency, and accountability, as well as continuing to improve the efficiency with which outcomes are delivered, as their contribution to sustainable national development.

Any risks that present generations find unacceptable should not be imposed on future generations. The discussion on sustainable development above primarily addresses resource use and the depletion of the resource base. In 1970, the Club of Rome (Meadows et al., 1972) published 'The Limits to Growth', which was revised and altered to accommodate new information several times. This statement appeared in a public document for the first time in the Brundtland Report (UN, 1987). We consider touching the following measures under the umbrella of the 2030 SDG targets: (i) no poverty; (ii) zero hunger; (iii) good health and wellbeing; (iv) high-quality education; (v) gender equality; (vi) clean water and sanitation; (vii) clean, affordable energy; (viii) decent work and economic growth; (ix) industry, innovation, and infrastructure; (x) reduced inequalities; (xi) sustainable cities and communities; (xii) responsible consumption and production; (xiii) climate action; (xiv) life below water; (xv) life on land; (xvi) peace and justice; and (xvii) strong institutions and partnerships to achieve the SDGs (UN, 2015). Although these goals need to be covered to a certain depth, our clear priority here is SDG (ii): the eradication of hunger (Weitz et al., 2017). If this issue is solved, many other SDG goals will be reached simultaneously.

Global DRR refers to the Sendai Framework for Disaster Risk Reduction, 2015–2030 (UN International Strategy for Disaster Reduction, 2015), which outlines the following priorities for action to prevent new and reduce existing disaster risks: (i) understand disaster risk; (ii) strengthen disaster risk governance to manage disaster risk; (iii) invest in disaster reduction for resilience and; (iv) enhance disaster preparedness for effective response, and (v) to 'Build Back Better' in recovery, rehabilitation, and reconstruction. The framework aims

to reduce disaster risk and losses substantially in lives, livelihoods, and health, as well as in the economic, physical, social, cultural, and environmental assets of persons, businesses, communities, and countries over the next 15 years.

The Paris Agreement (UN Framework Convention on Climate Change, 2015) marked a breakthrough in international climate negotiations, and started the process towards decarbonisation in the second half of the 21st century. The main tasks laid out in the agreement include: (i) the ratification and entry into force of the agreement (so far, out of 197 contributing parties, 195 have signed and 171 have ratified the agreement [Potsdam Institute for Climate Impact Research, 2018]) (this task is completed); (ii) the completion of a necessary agreement described in the 'Paris rulebook' on a package of implementation decisions (this was completed by the end of 2018 at the 24th Conference of the Parties to the United Nations Framework Convention on Climate Change in Katowice); and (iii) the domestic implementation of nationally determined contributions (a new and ongoing process for all participating parties). Climate action within a country is a political process, and requires political leadership with inter-ministerial cooperation. To make nationally determined contributions a reality for development, it is necessary to provide financial means for capacity building and to involve the private business sector.

3.5 Improvement Measures

Improving and enhancing the adaptive capacity of countries in the ASEAN region is imperative to safeguard existing and future development progress in light of current and expected future climate variability, disaster frequency, and food production capacity. Barriers include the limited availability of scientific information, lack of communication, absence of a knowledge base on successful measures, and limited financial resources. Policymakers and planners need access to credible and context-specific climate information as a basis for decisions and one that is linked with financing. In practice, it is often appropriate to structure the adaptive process as a series of graduated steps, beginning with screening to identify exposure, sensitivities, impacts, and adaptive capacities, followed by more detailed analyses of critical areas (Anbumozhi, 2012).

Government agencies and public institutions need to (i) enhance communication between disaster and climate risk assessors and adaptation implementers; (ii) reduce the likelihood of conflict and duplication of efforts when managing disaster and climate-related risks;

(iii) lessen the chances of mistrust and misunderstanding between decision and policy makers and other stakeholders in adaptation activities; and (iv) overall, help to provide consistent, defensible, and useful advice to decision and policymakers with respect to adaptation roadmap priorities and practices.

The timing of administrative measures and dissemination of information is crucial, and sufficient time must be allotted if a broad public and ideally all stakeholders are to be involved. If a coordination task is taken up by several or no agencies or stakeholders, this creates inefficiency. To elaborate a comprehensive framework, like DRR and CCA for food security, it can be useful to collect several proposals from sector agencies and interest groups; however, broad participation by many stakeholders will prolong the implementation process unnecessarily. Alternatively, joint working groups from several sector agencies involving key stakeholders can lead to faster solutions.

Existing data and information, as well as information management systems, must be integrated into DRR, CCA, and food security measures. While this may require additional initial effort to source and harmonise dispersed and disparate sets of information, it is likely to strengthen existing information management systems instead of marginalising them. Different information sources—international, ASEAN, national, and local—will be used simultaneously. Differences exist between general or universally applicable and specific information sources. Ideally, such sources, such as digital maps and databases, that refer to climate, soil, water, and landscape resources will already be available. Cooperation with local or national universities should be sought to bring in new information and analysis. Cooperation with schools can lead to even broader implementation that can support the implementation of DRR and CCA measures for food security at the smallest village- and farm-level scales, while keeping sight of larger local and regional scales.

Wherever possible and practical, existing decision-support tools and regulatory instruments should be used. These can facilitate and serve as a guide for the implementation of adaptation measures. Examples include risk assessments, environmental impact assessments, social impact assessment, and building codes. This will strengthen existing tools and regulations, instead of weakening them through confusion and inadequate enforcement.

Other available tools, including methods used in territorial, business, or financial planning include the following: (i) the 'strength, weaknesses, opportunities, and threats' analysis (Mindtools, 2018); (ii) the 'client, actor, transition, worldview, owner of the problem,

environment' approach to planning and management, in which actors responsible for making changes are identified (Checkland, 1981; Kukhnavets, 2017); (iii) scenario analysis (Hassani, 2016), in which several scenarios of a wanted or possible future are provided to assess the likely consequences thereof at a certain point in the future; and (iv) Local Agenda 21 and ecological restructuring approaches (Lyle, 1994), which offer advice as to how to regain previously lost land and water resources of a landscape.

Decisions as to when and how to adapt to disaster risks and climate change variability should be based on credible, comparable, and objective information. Ideally, the measurements and assessments required to provide this information will be made using internationally recognised, but locally adapted, methodologies and tools, thereby helping to ensure comparability amongst data collected by different assessors. For each kind of disaster, national or provincial vulnerability maps can be produced or adjusted for food security, in cooperation with available local and regional government agencies, resident universities, and involved stakeholders, and with the support or based on the guidelines of international organisations such as the FAO and UN International Strategy for Disaster Reduction. Recent disasters like the cylones Haiyan in the Philippines (Tuhkanen et al., 2018) and Nargis in Myanmar can provide a basis for comprehensive and standardised loss accounting for agriculture and the food value chain. While the cost of natural disasters, such as those incurred in averting fatalities and harm to infrastructure, is often known, that of damage to agricultural production networks and food value chains is often not registered, but can generate a share of 25% in losses (based on ad hoc assessments after disaster events) (FAO, 2015). Methods of calculating food production damage vary between countries. ASEAN countries have a unique chance to be at the forefront of measuring agricultural damage and losses by describing joint damage accounting methods, and preparing national inventories and a regional ASEAN inventory of disaster damage and food security. Adaptation activities should be based on cooperation to bring about desired changes, using both bottom-up and top-down approaches. Stakeholder involvement is also crucial (Haddaway and Crowe, 2018). This calls for enduring partnerships at all stages of the adaptation process, ensuring the active and equitable participation of private and public stakeholders, including business, legal, financial, and other stakeholders. However, such partnership requires partners of relatively equal strength or else a critical mass of concerned people within an area that is planning DRR and CCA to support food security. Thus, development aspects are to be included.

Thomalla et al. (2018) describe development and disaster risk as closely linked. People and assets are all exposed to risk. Their vulnerability to and capacity to cope with disasters are largely determined by development processes. Transformation is key to move from current development patterns that increase, create, or unfairly distribute risks, to forms of development that are equitable, resilient, and sustainable.

Many remote, local areas lack a critical mass of interested people and, increasingly, young people who are willing to stay in the area. Even when this critical mass is available in administrative centres, initiatives often cannot reach places with a particular need. Thus, already weak places will become even more disadvantaged relative to privileged locations. Subsistence agriculture alone cannot hold young people if they have better opportunities elsewhere. To reverse this trend, the agricultural value chain in remote areas needs to grow; otherwise, ever fewer people (mostly the old, ill, and/or less able) will stay. Schools may also face challenges as too few pupils may lead to their closing. The remaining pupils will have to begin commuting to distant schools, making their education more expensive for families. Remote rural areas will become continuously less attractive. A means of countering this trend is to establish functioning local markets wherever possible and to maintain or alter the economic basis of livelihoods.

On the other hand, the depopulation of remote rural areas as more villages are abandoned reduces the overall economic risk and burden inconsistently by reducing the number and value of potential disaster targets and lessening the amount of infrastructure to be maintained. Disasters can even become crucial and accelerating factors of centralisation, as small and remote places are abandoned and survivors are forced to move elsewhere.

With regard to global food security, centralisation, agricultural trade, technological innovation, and resource availability have become increasingly important. This is a game-changer for remote rural areas compared to the situation two generations ago in Europe or one generation ago in ASEAN countries, when agriculture was entirely based on the availability of land and local resources to produce food. Food and necessary resources to produce food are becoming increasingly dependent on imports and flows in supply chains. Emphasis must be placed on the objective of minimising the distributional negative impacts of disasters and climate change. Policy recommendations should be based on the ASEAN Socio-Cultural Community Blueprint, which provides advice to achieve a higher level of disaster resilience by anticipating, responding, coping, adapting, and building back better, smarter, and faster (ASEAN, 2016a). Continued commitment should follow in the spirit of

the ASEAN Agreement on Disaster Management and Emergency Response (AADMER), which has been effectively facilitating regional cooperation between and amongst ASEAN Member States (ASEAN, 2016b). As a legally binding regional agreement, the AADMER has directly contributed to the enhancement of DRR and CCA for the benefit of the peoples and communities in ASEAN.

ASEAN countries can also take the lead in still underexplored tasks in DRR and CCA. There are no joint procedures for assessing values at risk in food supply chains and the potential impact of different categories of disaster damage and losses (cyclones, droughts, floods, earthquakes, and tsunamis, amongst others) in a local or regional context. ASEAN countries can take the lead in describing joint damage and loss accounting methods and preparing a regional ASEAN inventory related to disaster damage, climate change impacts, and food security. This can involve the mixing of new and established methods adjusted to the circumstances of the ASEAN region.

3.6 Conclusion

ASEAN countries can be at the forefront by describing joint measures related to DRR, CCA, and food security at the regional (ASEAN) level based on the established national country roadmaps. In summary, an overview of the measures (structural, non-structural, control, and improvement) is provided in Figure 3.4.

None of these measures is entirely new. The innovative approach suggested here is to consider these measures simultaneously and achieve synergies by uniting them into a single assessment group, instead of creating three separate groups. The financial requirements of these measures differ, and structural measures will likely take the largest share of available finances. Even so, employing green infrastructure measures wherever feasible is much cheaper than relying on technical infrastructure. Non-structural, control, and improvement measures require a programmatic approach with clear dissemination and implementation targets. The aim here is to mainstream DRR, CCA, and food security and capacity building at the smaller administrative levels (provincial, district, municipality, village, and farm unit); however, this can be challenging if sufficient resources are not available. The final aim is to develop measurable criteria to ensure the success of an adaptation roadmap and to control how such criteria can be accomplished.

Figure 3.4: Overview of Measures for Association of Southeast Asian Nations Country Adaptation Roadmap

STRUCTURAL MEASURES	NON-STRUCTURAL MEASURES
• Technical Infrastructure ➡ Roads, Ports • Green Infrastructure ➡ Green Nets and Green Rings • Water and Food Storage Facilities • Urban Gardening • Agro-forestry Methods • Reclaiming of Wetland Areas • Afforestation and Forest Protection • Avoid Mal Adaptation	• Documentation of Disaster Events and Coincidence of Food Insecurity • Risk Awareness Rising in Institutions, Businesses and the Public • Land Use Planning and Hazard Zoning • Disaster Preparedness Planning • Exploring Motivations for Participation i in CCA and DRR • Provision of Financing of CCA and DRR
CONTROL MEASURES	**IMPROVEMENT MEASURES**
• Accounting of Disaster Damage and Loss in Agricultural Production and Food Processing • Check Legislation, Programs for Inclusion of DRR and CCA • Ensure Economic Transparency • Guarantee Proper Use of DRR, CCA Means • Provide Market Access and Appropriate Food Distribution Channels	• Educational Programs for FS, DRR, CCA to Public Officers, Students, Civil Society • Inclusion of ASEAN Documents ➡ Blueprint, AADMER • Consideration of SENDAI DRR Framework • Combination with National Determined Contributions to Paris Accord • Compliance Sustainable Devt Goals 2030

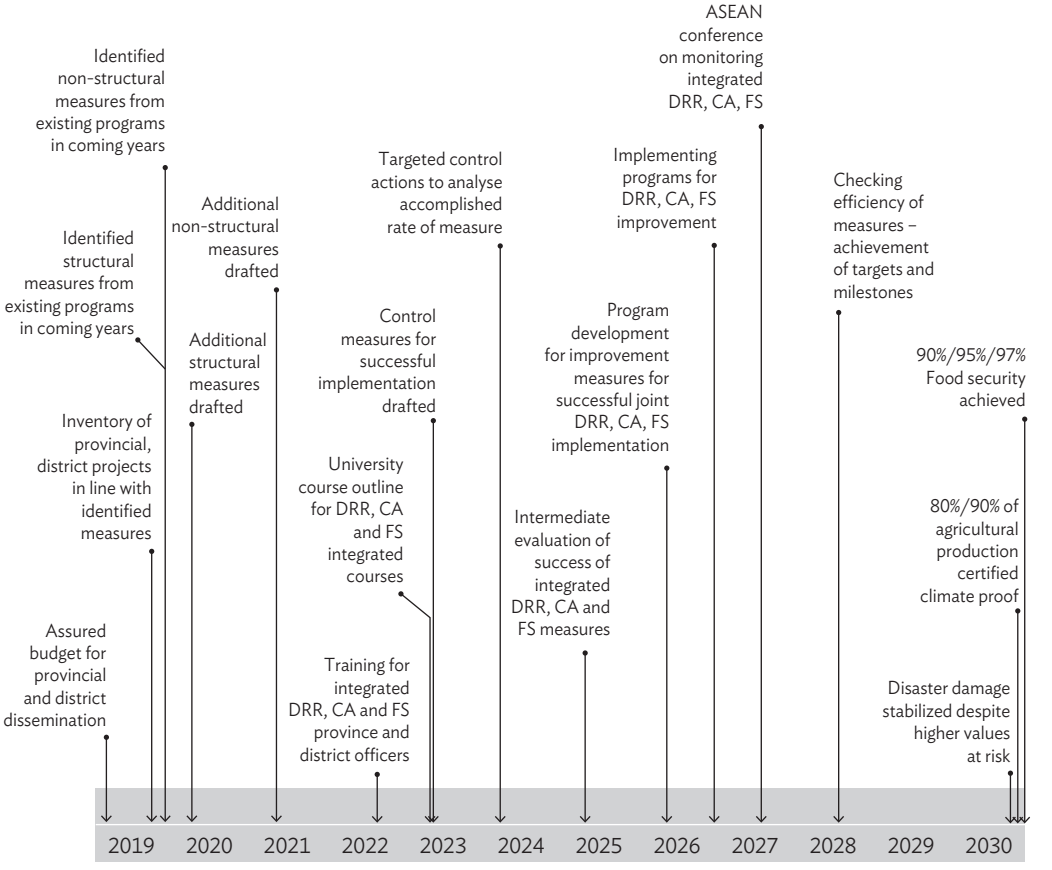
AADMER = ASEAN Agreement on Disaster Management and Emergency Response, ASEAN = Association of Southeast Asian Nations, CCA = climate change adaptation, DRR = disaster risk reduction.

Source: Author.

Finally, a sample timeline for country adaptation roadmaps is proposed (see Figure 3.5). We suggest a rather long timeline for this process and the year 2030 as a suitable target date for the successful implementation of DRR, CCA, and food security. The year 2030 is also used by international documents such as the Sendai Framework, and the new SDGs toward 2030. CCA is also likely to increase in intensity, at least from the viewpoint of avoiding ever greater damage.

The sample roadmap lays out the early, intermediate, and late milestones within the targeted 12-year period. The first step is to provide an initial adaptation budget based on international treaties and commitments. ASEAN countries actively participate in three major international frameworks and are committed to certain actions.

Figure 3.5: Sample Adaptation Roadmap for Association of Southeast Asian Nations Countries, 2019–2030



CCA = climate change adaptation, DRR = disaster risk reduction.

Source: Author.

Several projects and programmes can be classified as structural, non-structural, control, and improvement measures. While it is easier to find best practice or good guidance projects at the national scale, the aim here is to be more concerned with the smaller scale provincial level or, in the case of large provinces, even down to the district level. This exercise should make it possible to produce country hazard maps that incorporate new and updated information. This exercise may be followed by other measures from a longer term perspective, such developing courses to teach public officers or university students ways to keep disaster risks and damage low, or how to employ green infrastructure or other

structural measures to abate climate change and safeguard agricultural production as the basis of food security. Control measures must first ascertain whether the adaptation is on the correct track with regard to the three objectives of DRR, CCA, and food security. This will inform the involved parties whether the intended aims can be reached or if additional efforts are required. In the coming years, improvement programmes and measures will likely be necessary. Provinces may benchmark their districts to analyse different trends in a particular region and to find explanations for them. Country-wide or ASEAN conferences will provide platforms to exchange experiences of adaptation efforts and may motivate participants to explore diverging developments within countries, provinces, or districts over time. This may increase the efficiency of adaptation programmes and measures. Finally, countries can set targets, either in line with or slightly diverging from the aims set in the overall international frameworks. While some countries will target zero hunger or 97% food security, others may find it acceptable if 10% of people are temporarily food insecure. Several countries may accept a higher level of damage from disasters, while others will target the stabilisation of such damage despite having more value at risk and a higher occurrence of more extreme events. Similarly, some countries may target a production area that is 80% climate-proof, while others may choose a different value according to their prioritisation of measures.

Finally, the adaptation roadmap is a planning document influenced by many known and unknown factors. Although surprises are inevitable, countries that are prepared are much more resilient than those who are not. Vulnerabilities should be identified at an earlier stage and countermeasures begun in a timely fashion. This will lessen the negative consequences of disasters, make it possible to cope with more climate change impacts, and guarantee food security despite increasing levels of uncertainty.

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