

## The Gap of Climate Adaptation Development of the Spatial Planning System in Taiwan: How the Multilevel Planning Agencies Respond to Climate Risk

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### Abstract

Recognizing that climate risk is a real threat to the environment and society, spatial planning plays a key role in developing adaptation policy responses as well as in integrating the territorial or spatial impacts of governmental sectoral policies. Planning for adaptation through policy intervention will speed up the implementation of climate risk management. Taiwan is situated in a region in which 73% of the population living in more than three natural disaster impact zones. How to cope with climate varieties more locally and increase national adaptive capacity becomes an important issue for public and private sectors and actors. To incorporate the concept of risk management into the supportive legislation, plan making, and procedures at different spatial levels across a range of time scales is the adaptation approach in spatial planning system. This paper uses a framework to elaborate how and what types of intervention in planning institution has been adopted or adjusted with case study in Taiwan. Two barriers in the stages of planned adaptation are multilevel governance and land use management. These barriers arise from the existed problems in spatial planning system and affect the effectiveness, efficiency, equity and legitimacy embedded in adaptation decision-making.

### 1 Introduction

IPCC's Fifth Assessment Report (WGII AR5) indicates impacts from climate-related extremes reveal significant vulnerabilities and exposures of many human systems to current climate variability. Those impacts induce risk to our society, economy and environment due to the interaction of climate changes or hazardous climate events occurring and the vulnerability of an expose system. Climate risk can be direct disasters, as in larger and/or more frequent floods, or more intense and/or frequent storms or heat waves; or less direct, as climate change negatively affects food supplies, or access to water needed or livelihoods. It results from the interaction of vulnerability, exposure, and hazard (see Figure 1Figure 1Figure 1).

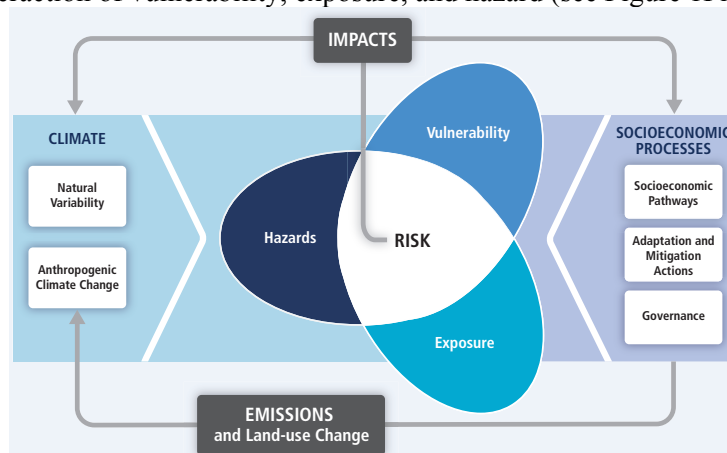


Figure 1 Illustration of the risk of climate-related impacts results from the interaction of hazards with the

vulnerability and exposure of human and natural systems. (Source: IPCC WGII AR5 Technical Summary 2014)

## 2 Background about climate adaptation policy context

### 2.1 Research background

Spatial planning has been identified as a critical mechanism through which climate change adaptation can be facilitated (Hurlimann & March 2012; Serrao-Neumann et al. 2015; Davoudi et al. 2009). This paper argues that planning provides a critical approach to climate adaptation by **four dimensions** embedded in spatial plan making, which are spatial, temporal, coordinative, and multilevel dimensions.

The research question is how has the process and tools of spatial planning system met climate adaptation needs in the governance structure in Taiwan's case. The framework that are based on to review spatial plans is developed on the article of Simin Davoudi (2013) and Moser & Ekstrom (2010). The empirical analysis including the interaction of planning actors and the policy documents are based on project involvement, interviewing governmental officials and **focus group discussion** from 2011 onwards.

By the empirical analysis by the framework, the intervention, tools and resources that are adopted or adjusted in planning system are assessed and the barriers of planning toward the success of adaptation planning are identified.

### 2.2 The important aspects of planning for climate adaptation

There is an complex interaction between changing climate and spatial development connected by climate process drivers and impacts, i.e. spatial strategies and its effect (human activities), the influence derives from urbanisation, land use and planning policies on the climate; and the impact of the extreme climatic hazards on different levels of space scale. All of these are complicated and require re-consideration of spatial planning in the light of climate risk management as essential components for adaptation planning. Although it is one of the key messages in the adaptation chapters of IPCC Assessment Report that spatial planning policies and strategies can trigger adaptation action across all sectors and geographic regions.

#### 2.2.1 Defining adaptation

IPCC Assessment defines adaptation as "Adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities". It involves reducing risk and vulnerability; seeking opportunities; and building the capacity of nations, regions, cities, the private sector, communities, individuals, and natural systems to cope with climate impacts, as well as mobilizing that capacity by implementing decisions and actions (Tompkins et al. 2010). Adaptation requires adequate information on risks and vulnerabilities in order to identify needs and appropriate adaptation options to reduce risks and build capacity. In this paper, identifying adaptation need/and or gaps focuses on the adverse effects that natural hazards and other climate impacts can have on a given location (Füssel & Klein 2006).

To achieve adaptation objectives and respond to climate risk at different spatial and societal scales, it is necessary to clarify that the purpose and outcome of adaptation is a continuous stream of activities, actions decisions and awareness that reflect existing social norms and processes. Linking with climate change, adaptation is a series of actions to reduce the vulnerability of a system (e.g. a social-ecological system), population group (e.g. a vulnerable population in some areas) or an individual or household to the adverse climate risk. It can take the form of autonomous, reactive or anticipatory adaptation. Autonomous adaptation is essentially an unconscious process of system-wide coping, e.g. ecosystem adjustment. Reactive adaptation involves a deliberate response to a climatic shock or impact, in order to recover and to

prevent similar damage in the future. Anticipatory adaptation involves *planned* action in advance to prepare for adverse impacts and attempt to minimize those risks.

### 2.2.2 Risk-hazard oriented adaptation and adaptation options

The risk-hazard framework, drawn primarily from risk and disaster management, focuses on the adverse effects that natural hazards and other climate impacts can have on a given location (Füssel 2007; Füssel & Klein 2006). Although adaptation needs are specific to particular groups and places, they fit into a set of more general categories as summarized as five perspectives that are biophysical and environmental needs, social needs, institutional needs, need for engagement of the private sector, and information, capacity and resources needs (Noble et al. 2014).

There are many different ways that the range of adaptation options available could be categorized (Burton et al. 2005). Three categories of adaptation options are summarized in IPCC AR5 adaptation chapter: structural and physical, social, and institutional options. Among them, two main measures in institutional options are most related with planning. One is laws, regulations, and planning measures such as protected areas, building codes, and re-zoning are institutional measures that can improve the safety of hazard-prone communities by designating land use to support resilience.

### 2.2.3 Characteristics linking planning with climate change adaptation

The general/fundamental principles/characters/capacity underpin spatial planning system to facilitate climate change adaption strategies. Stead et al. (2008) identify six key principles that define the scope of spatial planning as democratic, subsidiarity, participation, integration, proportionality, and precautionary principles. Many literatures have noted the role of planning in climate change adaptation. Hurlimann & March (2012) build five common planning tool types associated with planning for adaptation. Based content analysis and the emerging concepts of betterment and post-disaster planning in the pre-disaster phase, Serrao-Neumann et al. (2015) propose a typology of enablers to maximise synergies between disaster risk reduction and climate change adaptation by planning systems.

As mentioned above, planning intervene climate risk management by the way to (1) integrate different interests of different stakeholders in different spatial scale in policymaking process (Simin Davoudi, Jenny Crawford 2009; Bulkeley et al. 2009) , (2) reduce vulnerability and by building the resilience of places to climate by mainstreaming adaptation into spatial plans (Wilson 2006; Leary et al. 2008; Davoudi et al. 2009; Brown 2011; Kumar & Geneletti 2015). Being possessed of these characters, planning has important aspects for climate change adaptation. Through surveying the terms used in theories of planning and adaptation, common characteristics link spatial planning with climate change adaptation (see Table 1)

Table 1 Key terms show the common characteristics linking spatial planning with climate change adaptation

Terms used in	Spatial planning	Climate change adaptation
Concerned		
<b>Time scale</b>	Present to 20 years normally	Present to future (> 20 years)
<b>Spatial concern</b>	Building site to inter-nations	Building site to international
<b>Disaster preparedness</b>	Precautionary principle	Hazard-risk approach
<b>Coordinative integration</b>	Horizontal and vertical coordination	Multilevel governance
<b>Benefitted system</b>	Society, economics, environment	Society, economics, environment
<b>Institutional complex</b>	High-related	High-related

## 2.3 Operational definition

### 2.3.1 Clarifying adaptation planning and planning for adaptation

‘*Adaptation planning*’ and ‘*planning for adaptation*’ are defined as with different content, tools, procedures, and objectives. ‘Adaptation planning’ comprises a whole process to understand, to plan and to manage for climate change impact (see Figure 2). ‘Planning for adaptation’ is like a piece in a big jigsaw puzzle of ‘adaptation planning’. However, ‘planning for adaptation’ shares common principles with ‘adaptation planning’, but also exerts its own instruments, tools, methods, and principles which are provided depending on the different planning system and practicing purpose.

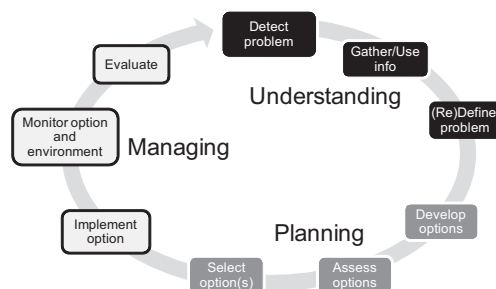


Figure 2 Phase throughout the process of climate adaptation planning (source: Moser & Ekstrom 2010)

This study focused on *planned adaptation* with the approach of risk management. *Adaptation strategy* is meant shared strategic vision and established priority outcomes through unambiguous policy statements with the overarching objective of reducing the vulnerability across sectors or focusing on just part of sectors or locality (qtd. in Biesbroek et al. 2010: 441). **Planning for adaptation** refers to respond climate risk at all spatial scale by spatial development and increasing the flexibility of institution in the planning system with multilevel governance. **Spatial planning system** in this paper denotes the **institution that the actors in multi-level governance and the action related spatial development interact with each other**. It is involved in the scope and scale of adaptation to climate change (see Figure 3).

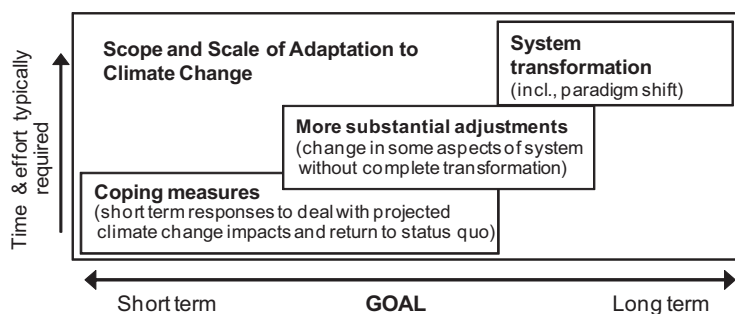


Figure 3 Scope and scale of adaptation to climate change (source: Moser & Ekstrom 2010)

## 2.4 Study context

Taiwan is very sensitive to the changing climate and is a high-risk natural disaster area. Typhoon, followed by severe floods and slope disasters is one of the major natural hazards often causing human death and economic losses, which might be up to US\$ 2 billion for a single typhoon. There has been research on the simulation of the impact of future climate change on Taiwan (Lu et al. 2011). The major concerns of climate change include sea-level rise, extreme weather events, precipitation change, and temperature. The magnitude and frequency of disasters associated with extreme weather and climate events have increased in recent years.

About 70% of the population lives in areas that occupy less than 20% of the total land area (ref Figure 4). The interaction between its natural-social condition and climate changes exacerbates these problems:

water soil compound disasters caused by extreme weather and land development, water resource problems resulting from uneven rainfall and increasing water demands, coastal changes caused by land subsidence, sea level rise, and increasing storm surges (see Table 2). The spatial distribution of these high-risk areas includes river basins (water-soil-bridge-road compound disasters), urban areas, mountains (highly vulnerable and environmentally sensitive), and coastal and land subsidence areas (highly vulnerable to disasters).

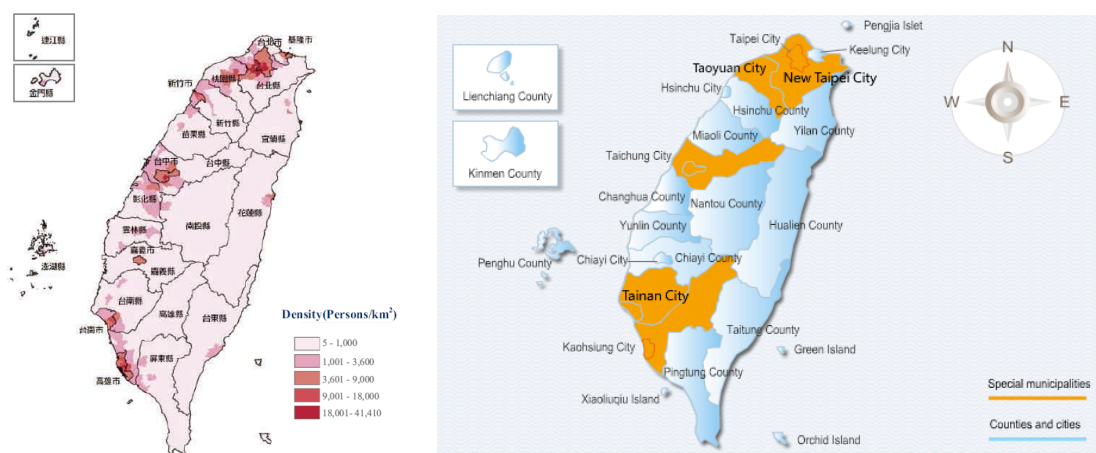


Figure 4 Population density and local jurisdictional territories

Table 2 Main disasters caused by climate and environmental change

Factors of climate and environmental change	Impacts on floods	Impacts on slopeland disasters	Impacts on compound disasters
<b>Increase in extreme precipitation intensity</b>	Intense precipitation exceeding the carrying capacity of regional drainage systems or dike protection standards will increase flood risk.	Increasing precipitation intensity will raise the risk of slope disasters, which affects the safety of mountainous routes, communities, tourism industries, and minorities without resources to manage disasters.	The effects of compound sediment and flood disasters will increase, affecting government emergency response planning and long-term disaster prevention or reduction policies.
<b>Increase in frequency of intense typhoons</b>	Successive large-scale disasters will affect the emergency response and recovery capabilities of disaster prevention systems.	The increase in typhoons will cause more recovery and reconstruction problems for slopeland disasters than flood disasters. Successive disasters will increase the risk of repeated disasters and threaten the emergency response and recovery capabilities of disaster prevention systems.	Aspects affected include the following: <ul style="list-style-type: none"> <li>Disaster prevention and emergency response capabilities in high-risk disaster areas;</li> <li>Safety of infrastructure (such as reservoirs, bridges, dikes, and electricity towers);</li> <li>Stability of water quality, reservoir operations, and droughts;</li> <li>River channel erosion, sediment transport, riverbed deposition, and repeated disasters; and</li> <li>Driftwood and landslide dam problems.</li> </ul>
<b>Uneven distribution of precipitation in wet and dry seasons</b>	Uneven precipitation will affect reservoir storage capacity, water quality stability, reservoir operation safety, and downstream flood risks.	Uneven distribution of precipitation will affect soil water retention capacity, which threatens the sustainability and safety of the soil and water environment.	
<b>Sea level rise and land subsidence</b>	Sea level rise will make flood discharge more difficult when heavy precipitation events occur, increasing flood risk in low-lying coastal and land subsidence areas.		
<b>Environmental impacts of frequent earthquakes and devastating disasters (such as Morakot)</b>	Increased environmental vulnerability after disasters and the recovery and reconstruction of public construction will increase the probability and risk of subsequent disasters occurring.		

(source: Lu et al. 2011)

## 2.5 The transition of Taiwan's planning system in climate policy context

Following the international trend of responding to climate change, the national governmental action started by setting up a cross-sectoral task force namely Working Group of Global Environmental Change in 1992. This group then has been promoted as National Council for Sustainable Development under Executive Yuan in 1997, which are composed of academics, governmental decision-makers, representative of NPOs and NGOs. Most of the policies and strategies associated with environmental change for the country were integrated and reviewed by the council. By the 1990s, the analysis of environmentally sensitive areas and the delineation of protected areas triggered an integrated approach to spatial planning via a perceived need to incorporate resource conservation (Kuo & Huang 2010). Spatial planning has been expected to play an important role in resource conservation by the increasing frequency of natural disasters at the beginning of the twenty-first century also led the government to place more emphasis on national land conservation and restoration.

After the 921 Earthquake in 1999, the already vulnerability of much of central Taiwan was made even more fragile. Every typhoon or extreme precipitation event would cause large-scale floods and slope land disasters. Besides being beset by natural constraints, illegal logging and land use of environmentally sensitive areas generally worsened the already bleak state of the natural environment in Taiwan. The cost of flood prevention works had increased steadily and the safety of many of the aboriginal indigenous communities was under threat. The central government therefore drafted bills and policy to strengthen its existing national land conservation policies. The core principle is the hazards were a warning signal of overdevelopment. Attention therefore shifted from using engineering methods to prevent disasters toward limiting human activity and development in mountain areas, especially in those vulnerable areas (Kuo & Huang 2010).

The first governmental policy action related with the term climate change adaptation is traced back to the plan of river basin management initiated by water management sector in 2006 for solving severe flooding as well as subsidence in south-western coastal area. Structural and institutional adaptation options are firstly integrated into flood prevention work by central governmental as an integrated way to respond to climate variability issue.

In 2009, Typhoon Morakot brought high flood discharge, long duration rainfall that lasted more than fifty hours with max 1623 mm daily rainfall and caused 623 deaths. It triggered the national planning agency to develop national climate adaptation policy guidelines as a form of intervention in the public interest. This agency, the Council of Economic Planning and Development (CEPD), is responsible for drafting overall plans for national economic development, carrying out its advisory functions by working objectively to integrate the views of different government agencies, and facilitating decision-making in central government. Following policy guidelines, adaptation action plans and programmes with disaster management thinking across ministries were fragmentally integrated in 2011. The local authority requires a clear and explicit guidance with the form of national statements from the central to legitimize the status of climate adaptation (Wilson and Piper, 2010). For promoting climate adaptation policy development by top-down approach, the central planning authority assists two local governments of demonstrative areas in planning for local climate adaptation strategy (LCCAS) by commissioning the academia to partner with the representatives from the municipalities as well as to build up the standard operating procedure (SOP) of initiating LCCAS (see Table 4).

Referring to the categorization of Biesbroek et al. (2010) article, key drivers for the development of national adaptation strategies in Taiwan have extreme weather events, examples from other countries, and

scientific research. Key facilitating factors are political will and active people with expertise taking lead. Over the past decade, the role of planning in national and local level has expanded from ensuring climate mitigation to ensuring climate adaptation policy delivery.

### 3 Planning intervention for climate adaptation needs in Taiwan

This paper proposes a framework to evaluating how has Taiwan's planning system responded to climate change adaption needs? Here, this study adopts the approach of disaster risk reduction to adaption needs through spatial plans initiated by multilevel governments. Through the framework, the gap between existed planning and successful planning toward climate adaptation is identified.

#### 3.1 Relationship between planning and adaptation needs

The academic literature using framework to analyze adaptation can be divided into three group according to analyzing purposes: the first is to provide a systematic analysis of what is and how assess adaptation itself, the second is to explain adaptation policy or strategies, and the third is to identify the adaptive capacity of a system. For example, Moser & Luers (2008) propose a framework for evaluating the adaptive capacity of specific resource managers prepare for climate risk with three critical dimensions—awareness of climate-related risks, analytic capacity to translate such climate risks information into specific planning and management activities, and the extent of actions taken to address the risks. They illustrate the application of this framework in their work through preliminary research of California coastal managers where we identify limited awareness of climate-change related risks, limited analytic capacity, and significant constraints on the abilities of institutions and individuals to take adaptation actions. The other literature providing frameworks to elaborate adaptation planning are the work of Smit et al. (1999), Gallopin (2006), Moser & Ekstrom (2010), and Kumar & Geneletti (2015).

Venton & Trobe Sarah La (2008), Hurlimann & March (2012), and Serrao-Neumann et al. (2015) have demonstrated that planning is widely acknowledged to have a potentially significant role in adapting to climate change or namely disaster risk reduction. Davoudi (2013) addresses the extent to which planning has influence in tackling climate change depends largely on how broadly it is defined and what level and types of interventions, tools and resources are available to it.

For analysing the response of planning for climate adaptation, in line with the government policy of multilevel planning agencies in Taiwan's case. Here, planning approaches to climate adaptation associated with disaster risk reduction through two dimension/tools: strategic planning and integration, land use management as the following and Figure 5:

- *Strategic planning and integration* is a rational process to formulate from short to long-term strategy; to coordinate cross sector policies horizontally as well as to integrate different levels of jurisdiction vertically. Adaptation measures are increasing and becoming more integrated within wider policy frameworks. Integration streamlines the adaptation planning and decision-making process and embeds climate-sensitive thinking in existing and new institutions and organizations.
- *Land use management* is regarded as an effective tool for decreasing disaster risk and adjusting to climate varieties by the implementation in various laws, acts, regulations and decrees, which can be categorized into four groups – land use planning and zoning, building control, disaster management and natural resource management (Lin & Chen 2010). In land use planning process, *public participation* will be involved to let stakeholders aware of climate risk.

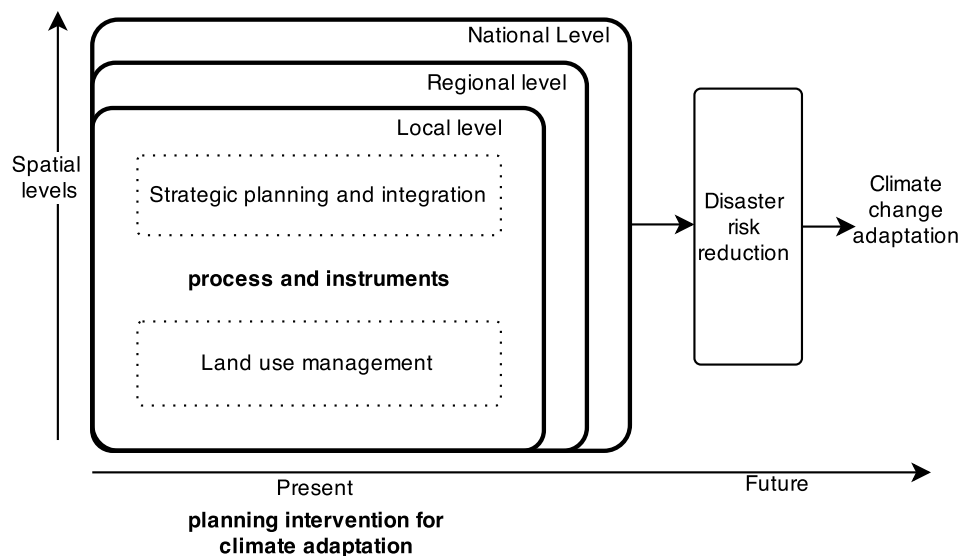


Figure 5 Planning intervention for climate adaptation in Taiwan

### 3.2 Explaining Taiwan's planning response and its relationship with other policy sectors

#### 3.2.1 Briefing planning system composition and its transition characteristics

The administration of planning in Taiwan is in two tiers, central and local. The responsibility of the central government is limited formally to the provision of legislation and the final approval of the planning in urban and non-urban areas, which are all formulated by the Construction and Planning Agency of the Ministry of Interior (CPA). The special municipalities, counties and cities (with their constituent authorities, also see the right map in Figure) are regarded as local governments to be responsible for drafting regional plans, urban plans of municipalities and special district plans (see Table 3)..

However, the territory of planning hierarchy is divided into three levels: national, regional and local. At the top is the National Land Comprehensive Development Plan that is a goal-oriented blueprint to guide national spatial development and will be replaced by the future legislation of the draft National Land Planning Law. At the middle is the Regional Planning Law enacted in 1974 to control the development by regulating the use of non-urban area (occupying more than two third of whole area of the island). Another paralleled planning jurisdiction is National Park Law that is followed to the conservation of national parks. Four regional plans designated by CPA are the reference of responsible for, but the plan's guidance function has not come into effect for some important weakness. At the bottom level, urban plans are formulated in accordance with the Urban Planning Law (see Table 3).

In the 1960s, along with the urbanization brought on by rapid industrialization, spatial planning dedicated its efforts to planning in urban areas. In the 1970s, to protect agricultural land and prevent land prices from skyrocketing in non-urban areas, separate laws were promulgated for urban planning and rural planning. A National Land Comprehensive Development Plan for the Taiwan Area in 1979 by national planning agency, CEPD (Council for Economic Planning and Development), was approved in the late 1970s to establish a national land use plan designed to cope with the increasing social and environmental problems. By the 1990s, with the then prevailing trends of sustainable development and globalization, the analysis of environmentally sensitive areas and the delineation of protected areas triggered an integrated approach to spatial planning via a perceived need to incorporate resource conservation. The increasing frequency of natural disasters at the beginning of the twenty-first century also led the government to place more emphasis on national land conservation and restoration (Kuo & Huang 2010).



Table 3 Two tiers of planning authorities taking charge of three levels of planning territories

Planning territory	Policy plans & Laws	Statutory responsibility
<b>National</b>	<ul style="list-style-type: none"> <li>• National Comprehensive Development Plan (policy)</li> <li>• Regional Planning Law</li> <li>• National Park Law</li> <li>• Rules of Non-urban Area Land Use Control</li> </ul>	<ul style="list-style-type: none"> <li>• National Development Council (NDC<sup>1</sup>, the Executive Yuan)</li> <li>• CPA (Ministry of the Interior)</li> </ul>
<b>Regional</b>	<ul style="list-style-type: none"> <li>• Regional Planning Law</li> <li>• National Regional Plan (draft), Regional plans of Special Municipalities, counties and cities</li> </ul>	
<b>Local</b>	<ul style="list-style-type: none"> <li>• Urban Planning Law (Master Plan and Detail Plan)</li> <li>• Rules of Non-urban Area Land Use Control</li> </ul>	<ul style="list-style-type: none"> <li>• Special Municipality, County and City governments</li> </ul>

<sup>1</sup> NDC is the main policy-planning agency of the Executive Yuan, charged with the tasks of planning, designing, coordinating, reviewing and evaluating the nation's overall development. It coordinates the implementation of major policies for economic, social, industrial, manpower, land and political governance. CEPD merged other ministries into the NDC after organization restructuring of the Executive Yuan in 2014.

### 3.2.2 Strategic planning and coordination in multilevel governance as the planning intervention for climate adaptation

Multi-level governance is a conceptual framework, which is needed to capture the vertical and horizontal tiers of actors. It originated from the effect of the formulation after EU polity on each member states when initiating spatial development policies. The development of planned climate adaptation in multilevel government in Taiwan starts from the policy initiative in 2010 and trickling down through plan making and the control of development at the national and local levels across spatial scales. Policy making and funding is the way central government exert to trigger local response. In 2011, a Planning Guideline of Local Climate Change Adaptation Strategy (LCCAS) and two LCCAS pilot projects have been subsidized by NDC to assist other local governments to promulgate LCCAS. In the planning progress of pilot projects, local and central officials, experts, and NGOs jointly organized a platform to discuss the adaptation options for one year. Till now, eighteen cities or counties completed their LCCAS through the funding of NDC (see Table 4).

There are four official regional plans respectively covering the northern, middle, southern and eastern parts of the island. Each plans is thick in description of past trends and the current situation, CPA has been responsible for the regional plans and empowered to act as a regional planning authority but lack of any formal implementation mechanism to make these plan effect. Decisions regarding major national or local public projects have seldom referred to any of the four regional plans. Driven by the need to restructure the planning hierarchy and the threat of climate impact, in 2010, CPA propose a policy draft of National Regional Plan which integrates the principle of climate risk management with the land use planning in vulnerable coastal, mountain, and hot spot areas across administrative boundaries by revising the regulation in non-urban to direct local governments to initiate their regional plans. For moving the local 'regional planning' in particular direction, CPA commissioned a planning guidebook, emphasizing anticipatory adaptation, and subsidized those cities/counties with territory of non-urban land to initiate their regional plan so as to bridge the future enforcing of the National Land Planning Law. According to the objectives of adaptation strategies in the draft plan, planning intervention can be classified into three categories: to reduce the sensitivity of the effected system occurs, to alter the exposure of a system, and to increase the resilience of social and ecological system, e.g. urban growth management, river basin governance, reservation of agricultural land, etc.

The planned adaptation action in local level is triggered by national level, NDC, through joining the progress in formulating the LCCAS for two pilot areas, Taipei City and in PingDong County. The vulnerability, accumulated mitigation effort, the cooperating willingness of municipality, and the political importance in Taipei City are the reasons to be selected as demonstration. In the process of discussing the feasibilities of intervening local administration, Taipei city government reacted to the central command by setting up a cross-sector platform that integrates seven departments, research team, CEPD, NGO, nearby city: New Taipei City, and experts. Those adaptation options associated with planning instruments, mainly belong to the regular responsibilities in various sectors and concerned mostly the climate disaster only, can be classified as institutional or non-structural adjustment e.g. land zoning and regulation, urban design, mainstreaming climate adaptation, water and watershed management, awareness, and technological change.

Table 4 Climate adaptation planning process

Year	Policy/ Governmental actions (initiator)	Who are involved
2010	Set up a task force for formulating the Climate Change Adaptation Policy Framework (CEPD)	National government actors, academics, NGO/NPO representatives
2011	Publication of Taiwan Climate Change Scientific Report 2011 (National Science Council)	National government actors, academics,
2011	Development of two Local Climate Change Adaptation Strategies pilot projects (CEPD, Taipei City and PingDong County)	National government actors, academics, research teams
2011	Developing 'Planning Guideline of Local Climate Change Adaptation Strategies' (CEPD)	National government actors, academics
2012	Promulgation of National Adaptation Strategy to Climate Change in Taiwan (NDC)	National government actors
2012-2014	Conducting subsidizing project to promoting 15 local governments to establish their Climate Change Adaptation Action Plans (NDC)	National and local government actors, academics
2013-2017	Development and implementation of National Climate Change Adaptation Action Plan in eight sectors (NDC)	National and local government actors

### 3.2.3 Land use management as the planning intervention for climate adaptation

Taiwan is and cannot avoid of experiencing frequent disastrous weather event e.g. typhoons, heavy rainfall, drought, and heat waves. Frequent typhoons or heavy rains in one year, which cause landslides in the mountains and floods on the plains, may be followed by drought the next year. Four areas with high climate risk are river basins (water-soil-bridge-road compound disasters), urban areas (storm), mountains (highly vulnerable to debris flow and environmentally sensitive), and southwestern coastal (land subsidence and coastal erosion).

Adapting to part of these inevitable climate impacts with planning tools as adaptation measures has been implemented in various laws, acts, regulations and decrees, which can be categorized into three groups – land use planning and zoning, disaster management and natural resource management. In Taiwan, the Urban Planning Law explicitly states that safety is one of the major concerns when planning. In 1994, central government announced a Disaster Response and Prevention Plan that called for considering evacuation routes, open spaces for defensive purpose and refugee sites during the overall plan review process. These considerations were further incorporated into amended articles of the Enforcement Rules for the Periodic Comprehensive Review of Urban Plans, 2002, a subsidiary set of rules of the overall Urban Planning Law (Lin & Chen 2010).

As for the regional spatial level, Regional Planning Law and Rules of Non-urban Area Land Use Control regulate Taiwan's non-urban areas. Although the boundaries of urban planning areas are defined and approved according to the Regional Planning Law, the compatibility of land uses between adjacent urban and non-urban areas is seldom checked. The drafting of National Land Planning Law has been suggested

for improving such compatibility. The current or proposed land use planning and zoning laws have already considered new requirements for hazard reduction. In addition, land use control is also addressed in many natural resource management laws, such as the Tap Water Act, drinking water management statutes, the Soil and Water Conservation Act, the Slope Land Conservation and Utilization Act, the Forest Law and the Environmental Impact Assessment Act. The administrative organization for these natural resource management laws belongs to different ministries with requesting rigid land use control to reduce hazard risk jointly. Land use management/planning for disaster risk reduction needs effective governance to make it. For achieving this, development projects smaller than ten hectares are merely reviewed and determined by local governments. Projects with larger areas must be re-examined by the Committee of Regional Planning of the Ministry of Interior. The review work will focus on not only the project site but also its surrounding area, which may have intense environmental interaction with the project site. In practice, however, It takes time to check the completeness and accuracy of information that developers provide. For a fast growing area many projects may be sent in for reviewing. It therefore becomes a pressure for the local governments to finish all the review process in a limited time.

## **4 Discussion**

Assessing planning for climate adaptation has tended to lag behind mitigation efforts both in research and in the climate negotiations. In part this is because adaptation and development specialists, governments, NGOs, and international agencies have found it difficult to clearly define and identify precisely what constitutes adaptation, how to track its implementation and effectiveness, and how to distinguish it from effective development (Burton et al., 2002; Arnell, 2009; Doria et al., 2009). Although planning is regarded as important approach to climate adaptation, in Taiwan's case it faces some barriers to successful adaptation. Adger et al. (2005) argue an action that is successful for one organization or one level of governmental agency level may not be classed as successful by another. Success therefore depends on scale of implementation and the criteria used to evaluate it at each scale. They explore a set of normative evaluative criteria for judging the success of adaptations at different scales in terms of the sustainability of development pathways into an uncertain future. These elements: effectiveness, efficiency, equity and legitimacy, reflect these principles embedded in adaptation decision-making, such as cost-benefit, trade-offs, and win-win strategy, are used to examine adaptation actions of Taiwan's case. Within the planning institution, this paper discusses the barriers of the planning intervention to adaptation by two dimensions: governance dimension and land-use regulation dimension.

### **4.1 Governance barrier to planning for adaptation**

The term governance refers to the sum of the many ways individuals and institutions, public and private, manage their common affairs. It is a continuing process through which conflicting or diverse interests may be accommodated and co-operative action may be taken and includes formal (e.g. legal, institutions) as well as informal arrangements (e.g. social norms). A key role that institutions and governance play in facilitating adaptation is through legal and regulatory responsibilities and authorities.

Bulkeley and Kern (2006) discern four governing modes for local authorities' climate change governance: self-governing, governing through enabling, governing by provision, and governing by authority. No matter through which governing mode, as city governments devise to initiate LCCAS, they tend to formalize and institutionalize their work in order to facilitate implementation and strengthen the legitimacy, coordination, and support for such policies across departments. One aspect of formalization is the establishment of dedicated climate units, either within a relevant department or as separate and crosscutting office. In Taiwan's case, the environmental department of Taipei city government takes charge of the coordination of the Panel on LCCAS, since linking the adaptation with mitigation action.

In Taiwan, the way of the planning authorities at national level influence others policy sectors through land use control and coordination at the same level and intervene in the governance at lower levels by top-down mode. The mechanism reflects the tradition of centralized planning system and the importance of the instruments of spatial planning in policymaking. The central government has been active to dominate the spatial development by framing national policy and direct public investment. In the absence of institutions, the actors in national and local governments are borrowing what they can from other policy domain or experimenting with different approaches to planning for identifying the suitable one to fit the climate governance. The interaction of actors at multilevel pushes the climate adaptation which has appeared in the planning process of LCCAS driven by the national government. The participation of private sectors or stakeholders follows the procedures of traditional land use planning mode, i.e. the involvement is still on the stage of information awareness. But some local governments are pursuing to join international alliance to learn best practice from other cities.

There is no regional planning authority between national and local level to integrate local development. The task of developing the National Land Planning Law handed down from the Executive Yuan of drafting a new NLPL implies the merger of urban and rural planning, but it has a difficulty to the CPA, considering that national land use planning must call for coordination and negotiation at ministry level that is far beyond the capacity of the CPA alone (Hua 2010). Besides, the CPA, which is the sector of land use planning at national level, it only has the land regulation and reviewing power. Due to its responsibility and organizational level, it is regarded as regulating land use but doesn't have the intent or mechanism to coordinate department plans or without the capacity to affect the policy of other sectors. That causes the struggle between the expectation of its role and real public administration.

#### **4.2 Land-use regulation & other barriers to planning for adaptation**

Laws, regulations, and planning measures such as protected areas, building codes, and re-zoning are adaptation measures that can improve the safety of hazard-prone communities by designating land use to support resilience. While zoning can be used to procure sites for low-income populations (Noble et al. 2014). However, the framework for spatial development in Taiwan has already been defined as a result of applying rigidly earlier zoning plans. This lack of flexibility and incentive for conservation makes it difficult to adjust when current comprehensive reviews of resource conservation are conducted. With the growing emphasis on mainstreaming adaptation strategies, spatial planning measures taken in one policy domain to reduce climate impacts are often not linked to the impacts of these measures taken in another policy domain (Biesbroek et al. 2009). The phenomenon is also observed in the process and implementation of policy formulation in national government. In adaptation policy, planning is not consistent in strategies and actions while it is divided into different sectors, instead of adopting the holistic point of view to integrate policies of different sectors for concerning the convenience of responsibility distribution.

According to the empirical case in Taiwan, the national policy planning and spatial planning support local adaptation action by the way of policy guiding and funding for initiating adaptation strategy. The local governments aware the climate risk and the importance to adapt, but has often not translated into the process of implementation of adaptation options. The reason for the gap between awareness and action can be summarized as: (1) adaptation is not viewed as the mainstream of responsibility of sensitive sectors; (2) adaptation is regarded as high importance, but low priority in local and national policy implementation for thinking it as an isolated task.

### **5 Conclusion**

Adapting to the climate impacts is a significant challenge at all relevant administrative, temporal and spatial scales (Adger et al. 2005; Urwin & Jordan 2008). Flexibility and integration are two important core

characteristics of climate adaptation that emerge from the process of institution framing and reframing in respective political system where planning can contribute as well as is embedded within.

The adaptation literature and this case study provide evidence that institutional capacity is a key factor in the process of planning for climate risk. Planning institution can also either enable or limit the scope and scale of adaptation to climate change. These barriers or enablers of planning for adaptation for most of countries addressed in IPCC AR5 as well as in this case study are: (1) multilevel institutional coordination between different political and administrative levels; (2) key actors, advocates, and champions initiating, mainstreaming, and sustaining momentum for climate adaptation; (3) horizontal interplay between sectors, actors, and policies operating at similar administrative levels; (4) political dimensions in planning and implementation; and (5) coordination between formal governmental, administrative agencies, and private sectors and stakeholders to increase efficiency, representation, and support for climate adaptation measures ((Noble et al. 2014). In Taiwan's case, institutional challenges as preparing for adaptation arise from the existed planning jurisdiction and governing modes.

This paper concludes with the barriers facing the planning system and with how to transform opportunities of spatial planning to respond with institutional complexity and uncertainty in the science of climate adaptation trend. Faced with the gap of planning instruments/process toward climate adaptation needs at different spatial levels, institutional, or jurisdictional dimensions based on this study, some suggestions for research about planning for adaptation in short term as well as for long term include: (1) How do multilevel governments increase adaptive capacity to respond to the trend of climate adaptation is challenging the planner to rethink his role in the policy making process. (2) How does adaptation principles can be mainstreamed into local government plan as well as daily responsibility, such as cost-benefit, no-regret, low-regret, win-win strategy, learning by doing, and keeping flexible; (2) While planning for adaptation, considering to offer development benefits in the relatively near term, as well as reductions of vulnerabilities in the longer term, that can strengthen the role of planning as a key adaptation tool.

## 6 References

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