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Proceed with caution:

Using a transaction cost framework and case study approach to explain how reactive adaptation to extreme climate events can lead to poor adaptation outcomes

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Abstract

The 'policy window hypothesis' in the context of extreme climate events, refers to a phenomenon whereby adaptation action is facilitated and occurs directly in response to extreme climate events. Despite the intuitive logic that extreme climate events may provide useful opportunities to design and implement successful adaptation policies, the literature suggests that this is not the case. With this thesis, the author aimed to uncover why reactive adaptation in response to policy windows opened by extreme climate events may result in poor adaptation outcomes. An explanatory framework based on concepts related to policy efficiency, new institutional economics and transaction costs was developed. The framework was then applied to the case of the 2011 Thai floods and the US$11 billion Master Plan for Water Resources Management that was developed in response. The findings suggest that failure to properly account for and manage the costs involved in the design of an adaptation policy program can lead to significant decision failures and implementation failures such as negative externalities and poorly designed or inappropriate measures. Such outcomes will involve additional actual and opportunity costs associated with resolving conflict and implementation delays. This is supported by documentary evidence from the Thai case study which suggests that the government's poor management of decision-making processes was later reflected in substantial and costly decision failures. It is now likely that much of the Plan will be scrapped. Given the significant resources that were invested in the design and preliminary implementation of the Plan, not to mention the potential avoided damage and loss associated with recent past and future flood events, failure to implement the Plan represents a mix of additional actual and opportunity costs and a poor outcome for climate change adaptation in Thailand. The framework and case study findings presented in this thesis, suggest that in response to extreme climate events policymakers should explore opportunities for adaptation, but proceed with caution. The presence of pre-emptive policy options in national adaptation plans may be able to reduce the likelihood that decision-making costs are neglected when pressure arises to take advantage of policy windows that open in response to extreme climate events.

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Keywords: Extreme Climate Events, Adaptation, Transaction Costs

Executive Summary

Severe flooding in Thailand in 2011 prompted the government to adopt a climate change adaptation policy program in response - During the last quarter of 2011, Thailand experienced its worst flooding since 1942 resulting in considerable loss of life and an estimated US$46.5 billion of economic loss and damage. The flooding was attributed to a range of factors including higher than average rainfall, urbanisation, insufficient drainage and flood protection and the particular slope of land found in the upstream parts of the central Chao Phraya watershed (Impact Forcasting LLC, 2012; Komori et al., 2012). The Thai Government responded to this event by implementing new national level water governance structures and a US$11billion national Master Plan for Water Resources Management. This Plan included both short-term measures to address the immediate crisis resulting from the flood and long-term measures to address future incidence of similar flood events.

Funding for the program was focused on traditional hard infrastructure measures, but also included provisions for improved planning and flood forecasting – Funding allocated for the Plan was focused largely on traditional hard infrastructure or structural measures such as dam, reservoir and flood way construction. However, the Plan also included non-structural measures such as dredging and the establishment of additional water retention areas (named 'Monkey Cheeks') and provisions for improved planning practices, flood forecasting and water management systems (Poaponsakorn & Meethom, 2013). Some of the specific elements of the plan involved controversial measures that had already been subject to lengthy public debate and even opposition.

The Thai case is an example of how extreme climate events, such as floods, may act as policy windows that can facilitate reactive adaptation - Adaptation policies and measures designed in response to extreme climate events such as those adopted in the Thai Master Plan are an example of reactive adaptation to climate change (Adger et al., 2005). Extreme events such as flood usually demand a reactive policy response because of their magnitude and their impact on human populations and economic activity (Johnson et al., 2005). In its fourth assessment report (AR4), the IPCC briefly investigated what it termed the 'policy window hypothesis', which referred to a phenomenon whereby adaptation action is facilitated and occurs directly in response to disasters, including those associated with extreme climate events (Adger et al., 2007).

Experience indicates that adaptation in response to extreme climate events results in poor adaptation outcomes - Despite the appeal and intuitive logic of the policy window hypothesis as it relates to extreme climate events and reactive adaptation, experience suggests that reactive adaptation in response to extreme climate events results in poor policy decisions. In the AR4 the IPCC goes on to cite a number of examples, which have been later supported by others, to suggest that reactive adaptation policy designed and implemented in immediate response to extreme climate events results in sub-optimal outcomes (Adger et al., 2007, 2005; Christoplos, 2006; Dovers & Hezri, 2010; Jeffers, 2011; Penning-Rowsell et al., 2006; O. Williamson, 2000). Credible explanations regarding why reactive adaptation in response to extreme climate events can result in sub-optimal outcomes will help policymakers identify issues or factors that need to be considered when faced with similar action situations.

With this thesis the author aimed to investigate why from a cost and efficiency perspective – The author investigated why reactive adaptation in response to policy windows opened by extreme climate events may result in poor adaptation outcomes, particularly from a cost and efficiency perspective. The investigation takes place in three steps. Firstly, an explanatory framework was developed based on concepts related to policy efficiency, new institutional economics and transaction costs. The framework analyses how specific factors characteristic of extreme climate events may, firstly, affect policymakers' estimates of the costs involved in developing and implementing adaptation policies in response to such events and, secondly, result in more costly and, sometimes, sub-optimal adaptation outcomes. Secondly, the framework was applied to the Thai case study. Particular attention was directed to the design and initial implementation of the adaptation elements of the now defunct Master Plan. Finally, other relevant theories of reactive policy development and governance were explored to attempt to draw out further insights into the findings of the framework and its application in the Thai case.

Reactive adaptation represents a cost trade-off between action and inaction - According to the explanatory framework, an extreme climate event leads to the convergence of the three policymaking streams – Problem, Policy and Political – to open a policy window to enact an adaptation policy program. Through a process of coupling one or a number of adaptation policy options emerge from the policy stream to form a policy response that is matched with the political will to adopt it. From a cost and efficiency perspective policymakers will be inclined to adopt the response that will involve the least overall cost. Thus, reactive adaptation is more likely to occur when the costs of action are estimated to be less than the opportunity costs of inaction or, put another way, maintaining the status quo (Dinar & Saleth, 1999).

The full costs involved in this trade-off involve a mix of transaction, production and failure costs – The costs of action and inaction involve a mix of transaction, production and failure costs. The full costs of action are equal to the transaction costs required to design and negotiate the program, costs to produce the desired adaptation good and opportunity costs resulting from a failure to properly account for the interests of all stakeholders or adopting poorly designed or unnecessary measures. The full costs of inaction are equal to the benefits forgone from not adopting a response plus the transaction costs required to maintain the current system and costs arising from the misspecification of the prevailing management system.

Policy windows and the embedded cost trade-off are nested within a physical/biological and institutional context - A given policy window and the cost trade-off are themselves nested within a physical/biological and institutional context. Due to the complexity of adaptation problems that often require extensive collective bargaining and involve high levels of uncertainty, it would normally be expected that the estimated costs of action are relatively high and action unlikely. However, the 'policy window' hypothesis supposes a number of adaptation drivers emerge to make reactive adaptation more likely including: new awareness of the risks posed by extreme climate events; the exposure of problems with prevailing policies and governance arrangements; weakening of vested interests; and enhanced political will to tackle the long-term impacts of climate change.

Failure to account for and manage costs can lead to significant failure costs and poor adaptation outcomes - These drivers that work to facilitate action may also encourage policymakers to overlook and underestimate important costs such as research, design and consultation with key stakeholders. Failure to properly account for and manage the costs involved in the design of an adaptation policy program can lead to significant decision failures and implementation failures such as negative externalities and poorly designed or inappropriate measures. Such outcomes will involve additional actual and opportunity costs associated with resolving conflict and implementation delays. For these reasons, the decision to adopt an adaptation policy program in response to policy windows arising from extreme climate events may lead to poor adaptation outcomes from a cost and efficiency perspective. In extreme cases, reactive adaptation that involves considerable decision and implementation failure as a result of underestimating or neglecting decision-making transaction costs may take on the form of maladaptation.

In the Thai case, cost and efficiency were factors in the decision to adopt the Master Plan – Key adaptation drivers that emerged following the 2011 floods, including heightened awareness of climate extremes, exposed weaknesses with prevailing policies and management systems and increased pressure from external stakeholders may have amplified perceptions of the opportunity costs of inaction and strengthened support for the Plan. Cost and efficiency were found to be a concern of the Thai Government when the Master Plan was being developed. At the time it was likely that the estimated costs of the adaptation measures included in the Master Plan, while significant, were considered far less than the unprecedented estimates of loss and damage that resulted from the floods and the failure of the prevailing water management system to cope with them.

Evidence suggests that key costs were overlooked or underestimated - Few resources were invested in designing the specific elements of the Plan or seeking feedback from stakeholders on the Plan's measures prior to or after the decision to adopt the Plan. Some key processes, such as impact assessments, and consideration of sensitive issues, such as land reclamation, were deferred until the implementation phase of the Plan and left to be managed by private contractors. While very little of the Plan had been implemented when this research was undertaken, there is also evidence that the implementation failure costs resulting from implementation of the Plan could have been sizable. It is likely that these costs would have grown should implementation of the Plan continued. The hard infrastructure called for in the Plan also likely involved significant technological 'lock-in' costs that would not have been apparent until sometime after the implementation of the Plan. Detailed evaluation of the Plan since it was adopted indicates that many of the measures planned were unnecessary and failed to account for other climate related problems such as drought.

Resulting in poor adaptation outcomes – The government's poor management of decision-making processes was later reflected in substantial and costly decision failures. Key stakeholders who complained of being poorly consulted increasingly opposed the Plan, which led to significant implementation costs including legal action and delays. Despite the scale of the climate threat the Plan was designed to tackle, very little of it has been implemented and its immediate future is in serious jeopardy. After a change of government in May 2014 it is highly likely that much of the Plan will be scrapped. In essence, the adaptation policy program

that was designed by the Thai Government to respond to the 2011 floods will not be implemented. In the context of policy windows, the scrapping of the Plan will be a significant missed opportunity for the Thai Government to strengthen the country's capacity to adapt to and mitigate extreme climate events; particularly those resulting from floods. Given the significant resources that were invested in the design and preliminary implementation of the Plan, not to mention the potential avoided damage and loss associated with recent past and future flood events, failure to implement the Plan represents a substantial mix of additional actual and opportunity costs and a poor outcome for climate change adaptation in Thailand

The findings presented in this thesis complement other theories on reactive policy development - Comparing and contrasting the findings with work on policy change scale and adaptive water governance seems to confirm that extreme climate events represent an important opportunity to advance adaptation policy due to the presence of unique adaptation drivers. These theories also suggest that due to the adaptation drivers associated with extreme climate events certain costs involved in the adaptation cost trade-off will be overlooked or underestimated, including institutional and technological 'lock-in' costs and decision-making costs such as consultation and planning. Applied to the Thai case these alternate theories suggest that the Plan's reliance on traditional hard infrastructure measures may have resulted in unforseen costs and that the high decision and implementation failures costs associated with the Plan were the consequences of the slight attention given to decision-making costs.

But there are limitations that could be addressed with further research - While the application of the explanatory framework in the Thai case was able to provide insights into why reactive adaptation in response to extreme climate events may result in poor adaptation outcomes; particularly from a cost and efficiency perspective, there are a number of limitations that should temper any conclusions regarding the broader relevance and applicability of the framework. Key issues include the framework's focus on negative adaptation outcomes, small sample bias associated with a case study approach and limitations associated with research methods relying on the analysis of secondary, documentary sources. These limitations could be addressed with further application of the framework to other cases and the use of empirical methods to quantify and compare costs.

The framework developed in this thesis will help policymakers better conceptualize the costs involved with reactive adaptation and avoid certain pitfalls - The value of the framework outlined in this thesis is that it attempts to provide a comprehensive overview of all of the actual and opportunity costs that policymakers should factor in their decisions regarding the whether or not to adopt an adaptation response to a given extreme climate event. It also highlights that regardless of the circumstances, action and inaction to tackle climate change will involve costs. A conceptual understanding of the costs involved with reactive adaptation and how estimates of these costs can be influenced by the adaptation drivers resulting from policy windows, will help policymakers avoid falling into the trap of believing that adaptation policy in response to extreme climate events is an inherently low-cost and efficient course of action

In summary, when faced with an opportunity to adopt reactive adaptation in response to an extreme climate event, proceed with caution - The framework and findings presented in this thesis, suggest that in response to extreme climate events policymakers

should explore opportunities for adaptation, but proceed with caution. The most important lesson to be taken away from this thesis is that the sense of consensus for decisive action in response to an extreme climate event should be resisted and not be used as a premise for reducing or avoiding important research and consultation processes necessary for policy development. Avoiding such processes is likely to lead to significant decision and implementation failures and poor adaptation outcomes. The presence of pre-emptive policy options in national adaptation plans may be able to reduce the likelihood that decision-making costs are neglected when pressure arises to take advantage of policy windows that open in response to an extreme climate events.

Table of Contents

List of Figures

List of Tables

Abbreviations

ADB – Asian Development Bank

AR4 – IPCC Fourth Assessment Report

AR5 – IPCC Fifth Assessment Report

DRR – Disaster Risk Reduction

ICEM – International Centre for Environmental Management

IPCC – Intergovernmental Panel on Climate Change

MoNRE – Ministry of Natural Resources and Environment

NCPO – National Council for Peace and Order

NESDB – National Economic and Social Development Board

NWFPC – National Water Resources and Flood Protection Committee

NWRC – National Water Resources Committee

ONWF – Office of the National Water Flood Management Policy

PDMO – Public Debt Management Office

RBC – River Basin Committee

RID – Royal Irrigation Department

SCRF – Strategic Committee for Reconstruction and Development

SCWRM – Strategic Committee for Water Resources Management

TPRD – Thailand Public Relations Department

UNFCCC – United Nations Framework Convention on Climate Change

WFMC – Water and Flood Management Commission

WMB – Water Management Board

1. Introduction

Adaptation policies and measures designed in response to extreme climate events are an example of reactive adaptation to climate change (Adger et al., 2005). Extreme events such as flood usually demand a reactive policy response because of their magnitude and impact on human populations and economic activity (Johnson et al., 2005). In its fourth assessment report (AR4) the IPCC briefly investigated what it termed the 'policy window hypothesis', which referred to a phenomenon whereby adaptation action is facilitated and occurs directly in response to disasters including those associated with extreme climate events (Adger et al., 2007).

Despite the appeal and intuitive logic of the policy window hypothesis as it relates to extreme climate events and reactive adaptation, experience suggests that reactive adaptation in response to extreme climate events results in poor policy decisions. In the AR4 the IPCC goes on to cite a number of examples, which have been later supported by others, to suggest that reactive adaptation policy designed and implemented in immediate response to extreme climate events results in sub-optimal outcomes (Adger et al., 2007, 2005; Christoplos, 2006; Dovers & Hezri, 2010; Jeffers, 2011; Penning-Rowsell et al., 2006; O. Williamson, 2000). Credible explanations regarding why reactive adaptation in response to extreme climate events can result in sub-optimal outcomes will help policymakers identify issues or factors that need to be considered when tasked with developing responses to such events.

In this thesis the author investigated why reactive adaptation in response to policy windows opened by extreme climate events may result in poor adaptation outcomes; particularly from a cost and efficiency perspective. The thesis employed the Thai Government response to the 2011 floods as an illustrative case study. These floods, considered the worst since 1942, were attributed to a range of factors including higher than average rainfall, urbanization, insufficient drainage and flood protection and the particular slope of land found in the upstream parts of the central Chao Phraya watershed (Impact Forcasting LLC, 2012; Komori et al., 2012). The Thai Government responded to this event by implementing new national level water governance structures and a US$11billion national Master Plan for Water Resources Management. This Plan included both short-term measures to address the immediate crisis resulting from the flood and long-term measures to address future incidence of similar flood events.

The investigation was implemented in three steps. Firstly, an explanatory framework was developed based on concepts related to policy efficiency, new institutional economics and transaction costs. The framework analyses how specific adaptation drivers characteristic of extreme climate events may, firstly, affect policymakers' estimates of the costs involved in developing and implementing adaptation policies in response to such events and, secondly, result in more costly and, sometimes, sub-optimal adaptation outcomes. Secondly, the framework was applied to the Thai case study. Particular attention was directed to the design and initial implementation of the adaptation elements of the now defunct Master Plan on Water Resources Management. Finally other relevant theories of reactive policy development

and governance were explored to attempt to draw out further insights into the findings of the framework and its application in the Thai case.

1.1. Background

1.1.1. Climate change and climate change adaptation

As evidence of changes in the earth's climate and resulting impact on human populations mounts, there is a growing interest in climate change adaptation and the policy and planning processes that facilitate successful adaptation. There is overwhelming consensus that global climate change is a reality. It is certain that average global temperatures will grow warmer in the future and likely that the incidence of climate-related phenomenon such as heavy precipitation events, tropical storms and intense droughts and floods will increase in many regions of the world (IPCC, 2012, 2013). These changes will have considerable impact on human populations and sectors with close links to the climate system such as water, agriculture and food security, forestry, health, and tourism (IPCC, 2012). As a result, climate change adaptation is becoming an increasingly important element of governments' national policy planning processes and experience with actual adaptation measures more regularly documented (IPCC, 2014).

The International Panel on Climate Change (IPCC, 2014) defines adaptation to climate change as a process of adjustment to actual or expected changes in climate and its effects in order to alleviate adverse impacts of change or take advantage of new opportunities. Generally, adaptation measures are designed to reduce vulnerability and enhance resilience to climate related changes (Adger et al., 2007; IPCC, 2012; Smit & Wandel, 2006). Vulnerability in the context of climate change refers to the propensity of human and natural systems to be harmed by climate change effects and can be thought of as a function of their exposure and sensitivity to the effects of a given change (Adger et al., 2005). Resilience can be defined as the ability of these systems to cope with climate related stresses and disturbances (Adger et al., 2005; Gallopín, 2006).

1.1.2. Types of adaptation

There are many forms and levels of adaptation (Smit & Wandel, 2006). At a fundamental level, adaptation involves the building of adaptive capacity, which aims to increase the ability of individuals, groups or organizations to adapt to changes and/or implement adaptation decisions and measures (Adger et al., 2005). However, adaptation can be further classified by categories such as timing in response to stimulus, intent, spatial scope and form. For example, at a spatial scale, adaptation measures could be located in different geographical regions or adopted by governments, communities and individuals at different administrative levels. The intent of adaptation responses can be differentiated on the basis of whether they are planned or autonomous, automatic responses to climate related stimuli (Smit & Wandel, 2006). Adaptation may also be deployed in response to perceived climate risks at different temporal scales. For example, adaptation may aim to address current climate variability, observed medium and long term trends in climate and future anticipated changes in climate based on climate models (Adger et al., 2005). Further, the timing of adaptation policies can be classified as anticipatory or reactive.

Adaptation policies and measures designed in response to extreme climate events are an example of reactive adaptation to climate related stimuli (Adger et al., 2005). Extreme events such as flood usually demand a reactive policy response because of their magnitude and impact on human populations and economic activity (Johnson et al., 2005). As a result, these events often result in the convergence of different forces to open a 'policy window' or opportunity to adopt an adaptation policy response. However, experience suggests that these responses often result in sub-optimal outcomes.

1.2. Problem definition

1.1.3. Policy windows, extreme climate events, and adaptation

Extreme climate events, while devastating, can also constitute a unique policy window for governments to develop and implement adaptation policies and measures. According to Kingdon (1995) policy windows represent opportunities to elevate a particular policy issue on the governmental agenda and to reach a point of action. Policy windows can be thought of as points of convergence where due to the specific combination of problem, political interest and policy solutions, actors on different sides of a particular problem or political issue may be compelled to overcome points of difference and bargain towards a policy decision (Henry, 2007). An important feature of policy windows is that they are generally time bound, requiring quick action on the part of advocates for a particular policy decision (Kingdon, 1995).

In its fourth assessment report (AR4) the IPCC briefly investigated what it termed the 'policy window hypothesis', which referred to a phenomenon whereby adaptation action is facilitated and occurs directly in response to disasters including those associated with extreme climate events (Adger et al., 2007). Underpinning the hypothesis is an assumption that a range of drivers can be leveraged during or in the immediate aftermath of an extreme event to facilitate an adaptation response. These drivers can include new awareness and consensus for action, the weakening of vested interests, enhanced political will and the opening up of new funding streams to support action (Adger et al., 2007; Christoplos, 2006). The timing of an adaptation action in relation to an experienced climate change impact may also affect the perceived efficiency of an adaptation action (Adger et al., 2005). As a result, in the context of the policy window hypothesis, policymakers may perceive that responding to an extreme climate event with substantial and rapid action that produces an immediate effect is more efficient than a pro-longed decision-making process that aims to produce a nuanced, long-term solution.

Despite the appeal and intuitive logic of the policy window hypothesis as it relates to extreme climate events and reactive adaptation, experience suggests that reactive adaptation in response to extreme climate events results in poor policy decisions. In the AR4 the IPCC goes on to cite a number of examples, which have been later supported by others, to suggest that reactive adaptation policy designed and implemented in immediate response to extreme climate events results in sub-optimal outcomes (Adger et al., 2007, 2005; Christoplos, 2006; Dovers & Hezri, 2010; Jeffers, 2011; Penning-Rowsell et al., 2006; O. Williamson, 2000).

A key reason cited in the literature for the poor performance of adaptation policy developed in reaction to extreme climate events is that in the period immediately following an extreme climate event there is pressure to quickly return to conditions prevailing prior to an event rather than to develop policies and approaches that might facilitate an improved future state (Adger et al., 2007; Christoplos, 2006). The potential for the development of effective long-term responses is further constrained by the fact that reconstruction and recovery from such events generally requires time to weigh, prioritize and sequence options (Adger et al., 2007). Thus, the time constrained nature of policy windows and other pressures that may manifest in and around extreme climate events mean that such deliberation processes may not occur, which is later reflected in poor policy outcomes.

Further investigation of how policymakers interpret and react to these particular adaptation policy windows is crucial to better assist policymakers take advantage of these opportunities and develop more effective adaptation plans and actions. While the topic of policy windows and extreme events was not explicitly revisited in the IPCC's fifth assessment report (AR5) on adaptation, a full chapter was dedicated to issues surrounding the opportunities and constraints to adaptation. Opportunities in this context are referred to as factors that make it easier to plan and implement adaptation actions, to expand the range of adaptation options or provide ancillary co-benefits (Klein et al., 2014). Extreme climate events, which usually provoke increased public awareness of climate change and the benefits of adaptation options, represent a heightened period of opportunity to enact adaptation. Indeed, the AR5 report goes on to acknowledge the linkages between economic development and disaster risk reduction and that extreme climate events provide a number of opportunities for enhancing resilience to natural disasters and climate change (Klein et al., 2014).

Therefore, despite agreement that policy windows arising from extreme climate events result in poor adaptation outcomes, they will continue to be important opportunities to enact adaptation. There is reason to believe that a better understanding of these phenomena may be an important way to improve adaptation outcomes. However, there have been relatively few attempts to systematically examine the specific workings of policy windows in the context of extreme climate events and why caution and restraint in the face of such events might constitute a useful rule for adaptation policymaking.

1.1.4. Efficient adaptation and transaction costs

Because of the uncertainty associated with climate change and the different distributional impacts of adaptation measures on private and common pool resources, it has been posited that successful climate change adaptation policies should be effective, efficient, equitable and legitimate, while also being consistent with broader sustainability objectives and sensitive to stakeholder needs at different spatial and temporal scales (Adger et al., 2007, 2005). However, the design and implementation of successful adaptation measures is constrained by the bio-physical properties of natural systems and institutional processes such as prevailing social norms, rules and regulatory structures (Adger et al., 2005). In this sense adaptation may be limited by the specific nature and features of the complex social-ecological system it aims to protect. Developing and implementing adaptation measures designed to deliver certain environmental goods requires managing constraints and trade-offs associated with the bio-

physical and institutional factors of a given social-ecological system. As a result, adaptation can involve significant transaction and other costs (Chambwera et al., 2014). In an adaptation context, transaction costs typically refer to the resources required to solve problems of collective action and work within and between institutions and organizations responsible for management of natural resources and the environment (Garrick, Whitten, et al., 2013; Marshall, 2013; McCann et al., 2005; McCann, 2013).

Transaction cost analysis is a sub-discipline of new institutional economics, and in the context of policy evaluation, it generally relates to the economic efficiency of a given policy trade-off (Brooks et al., 2005; McCann et al., 2005; O. E. Williamson, 1998; O. Williamson, 2000). In this context transaction costs are used to investigate whether the actual or anticipated results from a given policy response are justified by the resources required to achieve them (Mickwitz, 2003). Policy options that result in less overall cost are considered a more efficient use of scarce resources and, therefore, preferred. Transaction costs are typically just one cost category to be considered when assessing the efficiency of different policy options. Other categories of cost will include, among others, production or transformation costs associated with specific measures and opportunity costs associated with adopting one approach over another.

Often, the level or magnitude of transaction costs associated with a given policy choice will be influenced by the nature of the problem a given policy is designed to address. For many 'wicked' environmental problems such as how to address climate change or allocate scarce water resources, transaction costs are likely to be relatively high and relatively important for effective policy design (Garrick, McCann, et al., 2013; Marshall, 2013; McCann, 2013). In some cases they can be substantial and render otherwise beneficial adaptation action undesirable (Chambwera et al., 2014; Coggan et al., 2010; McCann et al., 2005). Costs associated with consultation and stakeholder engagement can be particularly significant and often overlooked. These costs arise in adaptation because of the need to act collectively to provide a shared good[1] and because the benefits of any adaptation action cannot be captured exclusively by one actor (Garrick, McCann, et al., 2013; Marshall, 2013).

Failure to properly account for the transaction and other costs associated with adaptation trade-offs could provide one plausible explanation why reactive adaptation in response to policy windows opened by extreme climate events may result in sub-optimal adaptation policies. Efforts to expedite a policy development process by excluding decision-making transaction costs associated with stakeholder consultation and coordination may result in larger than anticipated implementation costs resulting from poorly or hastily conceived plans and stakeholder opposition. In effect, failing to accept certain levels of transaction costs in the policy development process may lead to policy choices which actually hinder adaptive action or reduce adaptive capacity by either delaying the implementation of necessary measures or excluding other, potentially more effective, options.

[1] Namely reduced vulnerability or enhanced resilience to climate change

In addition, adaptation drivers of policy windows that arise from extreme climate events may encourage policy makers to over or under estimate the opportunity costs associated with a particular trade-off. As noted above, this could encourage policymakers to perceive that action is an efficient response to a given extreme climate event, but neglect important, perhaps, unintended consequences that result in greater overall levels of cost. In this way, reactive adaptation that fails to better account for transaction and other costs during the decision-making process may also eventually work to undermine broader efforts to adapt to climate change and constitute a form of maladaptation (see Barnett & O'Neill, 2010).

1.1.5. Investigating reactive adaptation to extreme climate events with case studies

It is important to investigate these issues further and, where possible, draw on past events as case studies. Credible explanations drawn from case studies regarding why reactive adaptation in response to extreme climate events has resulted in poor outcomes can help policymakers identify issues or factors that need to be considered when faced with similar action situations. As noted above, while there seems to be agreement that the policy window hypothesis as it applies to adaptation and extreme climate events is unfounded, there have been relatively few studies aiming to explain why this might be the case. Of the papers referred to in the AR4 section on the policy window hypothesis, only Christoplos (2006) provided a nuanced, although general, account of why the policy window hypothesis may be unfounded; although focused on the particular case of disaster risk reduction (DRR).

While other authors have used case studies to examine policy and adaptation responses to extreme climate events in more detail, these studies have tended to focus on broad contextual and historical issues rather than specific mechanisms related to policy performance (see Harries & Penning-Rowsell, 2011; Jeffers, 2011; Johnson et al., 2005; Penning-Rowsell et al., 2006). Interestingly, many of these studies have also looked at the role of institutions in the design and implementation of policy responses to extreme climate events and the path dependencies or institutional 'lock-in' that shapes these responses. The lack of documented cases investigating why reactive adaptation in response to policy windows opened by extreme climate events may result in sub-optimal adaptation outcomes presents an interesting research gap.

An interesting and well documented recent example of an extreme climate event that resulted in a significant response from government was the severe flooding that struck Thailand in the latter half of 2011. These floods, the worst to hit the country since 1942, exacted a considerable toll on the Thai people and the national economy. The Thai Government responded to this event by implementing new national level water governance structures and a national Master Plan for Water Resources Management (hereafter referred to as the Master Plan or, simply, the Plan). This plan was designed to reduce loss and damage from flood events, improve flood prevention capacity and to build confidence in Thailand's water management capacity (NESDB, 2012).

From an efficiency perspective, the approach adopted created significant, likely unintended, costs. Some have contended that bureaucratic 'short-cuts' were taken to expedite

implementation of the Plan, which may have increased opposition (CleanBiz.Asia, 2013; Limsamarnphun, 2013). Since it was approved and funded in January 2012 the Plan has been controversial and attracted intense public scrutiny and numerous legal challenges (ICEM, 2014a; Jikkham & Wipatayotin, 2014). As of June 2014 the future of both the new governance structures and the Master Plan are uncertain. Following a coup in May 2014, the new military regime in Thailand is set to consider whether the implementation of the plan should go ahead (Jikkham & Wipatayotin, 2014). It is possible that in this case, failure to properly account for transaction costs; particularly those necessary to address the concerns of stakeholders affected by the nature of the response, has produced inefficient and sub-optimal adaptation outcomes.

As Thailand is likely to experience flooding events of a similar magnitude to the 2011 floods in the future it is important to better understand how the Thai Government responded to the 2011 floods and what the outcomes were. Analysis of the response to the floods may suggest ways to improve government's response to such events in the future (Komori et al., 2012). At a broader level, lessons from the Thai Government's response to the 2011 floods will also be particularly relevant for policy makers charged with developing adaptation measures in response crisis events when there may be pressure to minimize decision-making transaction costs and act quickly to take advantage of a perceived policy window.

1.3. Research Questions

In this thesis the author aimed to investigate why reactive adaptation in response to policy windows opened by extreme climate events may result in poor adaptation outcomes; particularly from a cost and efficiency perspective. The investigation employed in this thesis made use of an explanatory framework based on concepts related to policy efficiency, new institutional economics and transaction costs. The author employed the Thai Government's response to the 2011 floods as an illustrative case study. The analysis used also drew on complimentary methods to strengthen the validity of any findings. Taking this in account, the overarching research questions that guided the subsequent analysis presented in this thesis were:

Research Question 1: *How does reactive adaptation in response to a policy window opened by an extreme climate event lead to poor adaptation outcomes from a cost and efficiency perspective?*

Research Question 2: *Did the adaptation policy program adopted by the Thai Government in response to the 2011 floods result or potentially result in poor adaptation outcomes from a cost and efficiency perspective and why?*

Research Question 3: *How could other methods of analysis support the findings in the Thai case?*

The unit of analysis used was a climate change adaptation policy program that was developed by a national government in response to an extreme climate event. In their review of institutions and policy processes as they relate to climate change adaptation, Dovers & Hezri (2010) define a policy program as the manifestation of a policy, which in turn is defined as a position taken or communicated by a government. Policy programs comprise elements of

implementation as well as intent to take action to realize adaptation related goals. For the purpose of this research the unit of analysis was further restricted to adaptation policy programs that were designed to address long-term climate impacts beyond the immediate impacts of a particular climate-related event.

1.4. Methodology

1.3.1. Overview

The methodology employed to address the research questions was based upon a combined case study approach. The primary case study approach employed in this thesis is causal process tracing. Causal process tracing is an approach that generally starts with an interest in a specific example outcome and looks to investigate what factors made this outcome possible (Blatter & Haverland, 2012). As a result, this approach is used to develop a comprehensive understanding of one or many possible causal processes or mechanisms that lead to the outcome under consideration. There is also a strong temporal element to causal process tracing in that it reveals not only the key factors that lead to a particular outcome, but also when and how these factors have to be brought together to create an outcome of interest (Blatter & Haverland, 2012). This makes it an ideal method to further investigate the workings of policy windows and adaptation outcomes arising from extreme climate events.

In the context of this thesis the outcome of interest is the poor performance of the Thai Government's adaptation response to the 2011 floods. However, the focus of the primary research question is much broader and aims to investigate why policy windows that open in response to extreme climate events may be poor opportunities to develop and implement adaptation policy. As a result, the causal process tracing approach was combined with the congruence analysis approach. Congruence analysis is a complementary case study approach that investigates and/or compare the merits of different explanatory methods (Blatter & Haverland, 2012).

The combination of these case study approaches was used to try and address the weak generalizability of case studies based solely on causal process tracing by integrating the theoretical investigations and comparisons that characterize congruence analysis. The combination of these methods is considered useful for small sample or single case research that aims to infer general theoretical insights that may find application beyond the scope of the specific case under investigation (Blatter & Haverland, 2012). Consistent with the broad focus of the central research question under consideration in this thesis, the combination of approaches outlined above was employed to improve the external validity of the findings in the hopes that the approach presented may be applied to other cases in the future to confirm its relevance and ability to confer insight.

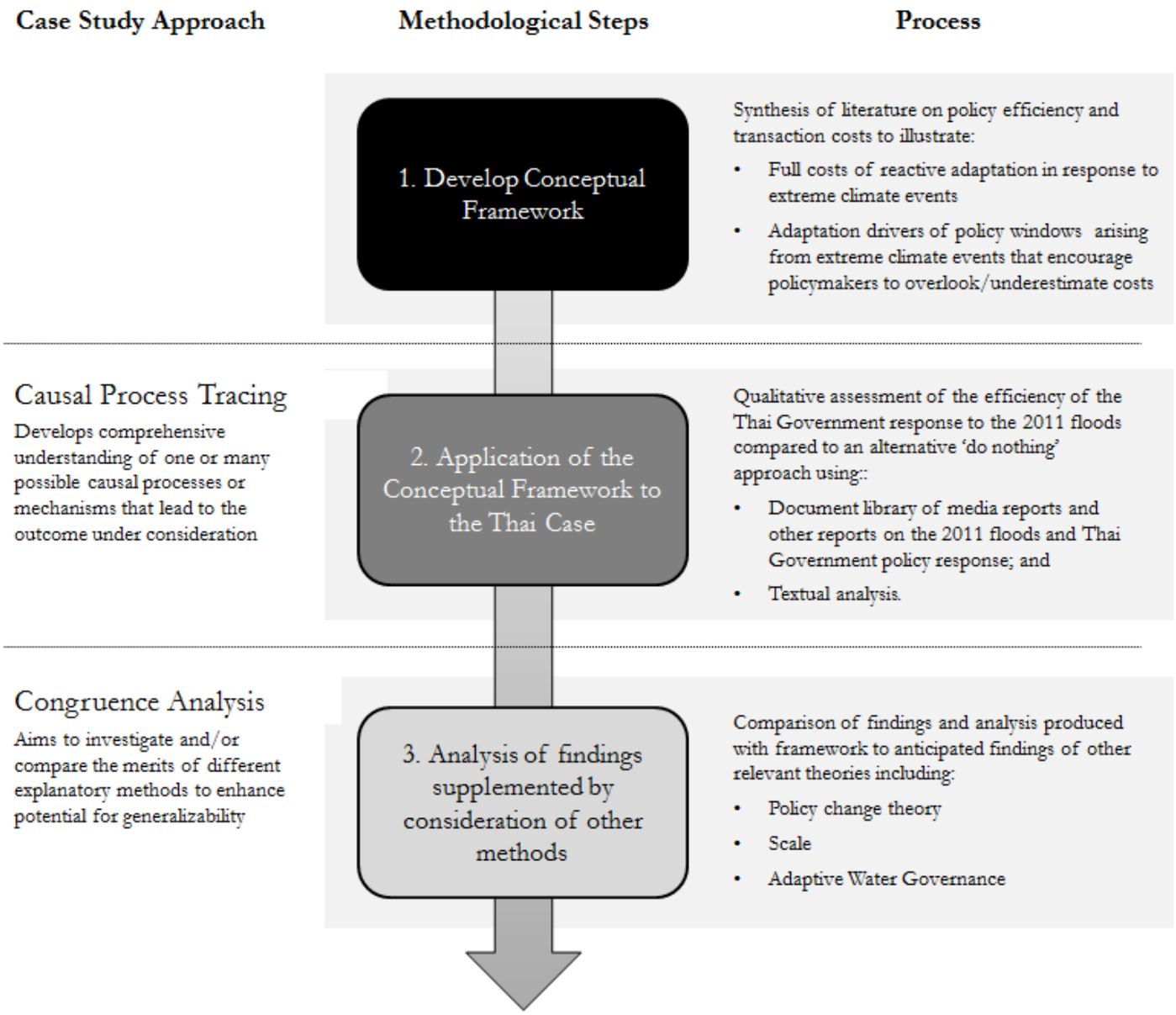

Figure 1-1 Overview of the research methodology

1.3.2. Methodological Process

The research questions were answered in a process involving three steps.

Step 1: Develop an Explanatory Framework

As noted by Schlager (1999), frameworks provide theories with relevant variables, posit relationships amongst them and make inferences about likely outcomes resulting from their interaction. In the nomenclature of causal process tracing this refers to tracing the features of one or more causal mechanisms that lead to a particular outcome. A central proposition underlying the research problem and questions specified for this thesis was that, when considering the cost or efficiency of a particular adaptation policy response, the way policymakers estimate and manage transaction costs during the decision-making process can influence the overall success of the response adopted. As a result, the first step of the

methodological process involved the development of an explanatory framework to analyse how specific adaptation drivers characteristic of extreme climate events may, firstly, affect policymakers' estimates of the costs involved in developing and implementing adaptation policies in response to such events and, secondly, result in more costly and, sometimes, sub-optimal adaptation outcomes.

The explanatory framework was developed based on a synthesis of transaction cost literature developed by North (1990) and Williamson (1998, 2000) and adapted to environmental policy decision-making and implementation by Birner & Wittmer (2004), Challen (2000), Garrick, Whitten, et al. (2013), Hanna (1995), Marshall (2013), McCann et al. (2005) and McCann (2013). The framework draws heavily upon the work of Birner & Wittmer (2004) to distinguish between transaction costs necessary to make policy decisions in a natural resource management context and transactions costs that are necessary for policy implementation.

In this case, the framework was used to specify the full economic costs involved in a simple trade-off between developing and implementing a policy response to an extreme climate event and maintaining the status quo – effectively a 'do nothing' with respect to adaptation. This type of trade-off may often arise in public policymaking during a 'Cabinet'[2] deliberation process where senior government ministers are asked to consider and endorse a particular course of action or policy solution, which has been prepared in advance by relevant ministries. Once the trade-off was specified the different cost elements were elaborated upon using more detailed cost typologies for environmental and adaptation policy developed by Garrick, Whitten, et al. (2013), Marshall (2013), McCann et al. (2005) and McCann (2013).

The framework was then used to consider how the specific adaptation drivers of policy windows that open in response to extreme climate events facilitate reactive adaptation by encouraging policymakers to overlook or underestimate the costs associated with adaptation policy programs. Finally, the framework was used to explain how reactive adaptation developed in such circumstances may lead policymakers to manage transaction costs in a way that leads to more costly and less efficient adaptation outcomes.

Step 2: Application of explanatory framework to Thai case

In the second step the explanatory framework was applied to the Thai Government's response to the 2011 floods; in particular the design and initial implementation of the adaptation elements of the Master Plan on Water Resources Management. Firstly, it was established that the 2011 floods and the Thai Government response conforms to the general characteristics of policy windows. Based on relevant documentary evidence, consideration was then given to evidence of the way that the Thai Government estimated and managed transaction costs in developing and implementing the Plan. Finally, the analysis was summarized to draw conclusions regarding whether the Thai Government response to the 2011 floods resulted or potentially resulted in poor adaptation outcomes from a cost and efficiency perspective.

[2] A committee of senior ministers responsible for controlling government policy (Oxford Dictionary, 2014).

Due to a lack of specific, detailed cost information and the well documented challenges in quantifying transaction costs associated with environmental policies (Birner & Wittmer, 2004; McCann et al., 2005), it was generally not possible to empirically quantify the transaction and other costs associated with the development and implementation of the Master Plan and compare them to alternative options. Instead the framework was applied in a qualitative manner to make inferences about whether the Thai Government response to the 2011 floods resulted or potentially resulted in poor adaptation outcomes from a cost and efficiency perspective and why. This evaluation was prepared using secondary data sources that are described in more detail below. This type of qualitative approach, based primarily on secondary data, has been commonly applied in the literature to develop in-depth, narrative accounts of adaptation responses to floods and other climate risks and their outcomes consistent with the aims of causal process training (Albright, 2011; Jeffers, 2011; Johnson et al., 2005; Kaika, 2003; Offermans & Cörvers, 2012; Penning-Rowsell et al., 2006)

The data underpinning the assessment was compiled in two stages. Firstly a document library was developed bringing together English language news reports from a wide range of sources on the Thai Floods and the Thai Government's response. Secondly, the document library was analysed systematically using structured matrices. To produce the matrices key terms from the explanatory framework such as 'decision and implementation transaction costs', 'decision failure', 'benefits forgone', and 'policy window' were used as categories for relevant findings. Each document in the library was then analysed to identify information relevant to the specific conceptual and cost elements of the explanatory framework. The matrices were then used to structure the subsequent analysis.

The document library includes reports from local and international media, official reports and academic and independent reports on the 2011 floods and water management in Thailand. The floods were covered extensively and more than 150 news reports from a period between June 2011 and August 2014 were collected for this research using search terms including '2011 Thai Floods', 'Thai Water Master Plan', and 'Water Management Thailand'. The library was supplemented with a document archive that was developed by the author and supplemented by the consultant team responsible for implementation of the Asian Development Bank (ADB) Technical Assistance project on *Strengthening Integrated Water Resource Management in Thailand*. The archive includes over 50 additional documents comprising water related legal and policy documents issued by the Thai Government, peer reviewed literature and translated summaries of environmental impact and strategic environmental assessments conducted by relevant agencies. The document library was further supplemented with anecdotal feedback from representatives of the Thai government, community organizations, water users and water sector professionals in Thailand collected during workshops conducted during July and August 2014 as part of the aforementioned ADB project.

Step 3: Analysis of findings supplemented by consideration of other methods

In the third step the findings from the application of the explanatory framework were analysed to determine their relevance and explanatory potential with respect to the central research question. Based on this discussion, and consistent with the aims of congruence

analysis, other relevant theories of reactive policy development and governance were explored to attempt to draw out further insights into the findings of the framework and its application in the Thai case.

The theories chosen include policy change, scale analysis and adaptive water governance. This analysis commenced with an overview of the theories in question and their central principles. Relevant findings from their application; particularly to instances of flood and water governance, were then contrasted and compared with the findings and analysis from application of the explanatory framework and the specific features of the Thai case. The results of this analysis were then synthesized to inform some lessons learned for the development and implementation of reactive adaptation in response to extreme climate events and suggestions for further research.

1.5. Scope and limitations

A number of practical and methodological choices were made to try and limit the scope of this research, while simultaneously improving the likelihood that it may produce some relevant and useful insights about the cost and efficiency of reactive adaptation in response to policy windows arising from extreme climate events. However, these choices also involved a number of limitations. Where possible additional research design choices were made to try and address these limitations.

The unit of analysis was restricted to climate change adaptation programs with a long-term focus. Disaster response measures that are adopted during or immediately after an extreme climate event to restore social, economic or environmental function to an area adversely affected by an extreme climate event are not considered. For example, the analysis did not take into account short-term measures to mitigate or clean-up after an extreme climate event or financial relief that is usually provided to victims of these events. Limiting the scope in this way allowed for closer examination of how governments react upon a policy window to take up a policy or decision agenda outside the immediate scope of the extreme event itself. Generally, adaptation policies are not required to restore a system damaged by an extreme climate event to its original state and therefore require a trade-off between the resources required to adopt an adaptation program or invest those resources in another issue on the government agenda. By focusing only on adaptation undertaken by government institutions in response to an extreme climate event, the framework also did not account for costs borne by private actors who implement adaptation measures in response to the same event. It also did not explicitly model interactions between stakeholders in the policy development process, which may otherwise have provided useful insights from the literature on management of common-pool resources[3].

While mainly based in the theoretical foundations of policy evaluation and cost-benefit analysis, the explanatory framework was restricted to consider only issues of cost and efficiency involved with the trade-off of whether or not to adopt adaptation policies in response to an extreme climate event. Such trade-offs will often present themselves in public

[3] For example see Abdollahian & Alsharabati (2003); Burke (2001); and Lubell (2003).

policymaking processes towards the end of a decision-making process Cabinet Ministers are asked to consider whether or not to adopt a pre-prepared policy solution or program. As the framework focuses only on costs, it did not explicitly consider the benefits of adaptation action. However, the potential benefits of adopting adaptation policies were incorporated into the framework as a cost of inaction; namely benefits forgone. Similarly, the benefits of action were incorporated as a reduced (and potentially negative) decision and implementation failure costs.

Framing the policy choice as a simple trade-off of the costs involved in adaptation action and inaction effectively restricted the range and complexity of potential policy options considered. While this methodological choice simplified the data collection exercise and analysis required the framework did not draw upon relevant insights from the extensive body of literature elaborating and critiquing rational choice problems as they apply to institutions and policy development[4]. Similarly, as the framework collapsed multiple decision processes about different policy options into a set of broad variables, it was not able to offer insight about more complex decision-making problems that may involve multiple policy options and different preference configurations (Jones, 1994).

Despite these limitations, the transaction cost literature often highlights the necessity of comparing the costs associated with a particular policy response to those that result from a 'do nothing' or status quo alternative (Garrick, Whitten, et al., 2013; Marshall, 2013). This is because maintaining the status quo will actually involve a range of embedded transaction and other costs which, due to the fact that they are embedded in an existing system and often invisible to those operating within the system will not be considered when assessing the relative efficiency of a simple policy-trade-off.

As the framework was based upon methods of policy evaluation and cost benefit analysis, it is susceptible to common criticisms levelled at these theoretical approaches such as an inability to account for all costs associated with a particular action; particularly externalities, allocating costs to resources that do not reflect their true value and failure to properly account for the temporal effect of policy decisions with significant future impacts through discounting. Many of the costs included in the framework have also been considered difficult to quantify (Garrick, McCann, et al., 2013; McCann et al., 2005). This is because many of the costs included in the framework are not explicitly measured or are associated with future or uncertain events that require the use of proxy values or estimation (Birner & Wittmer, 2004; Marshall, 2013). Subsequently, quantification of each cost variable was considered outside the scope of this thesis. While quantification of the costs identified in the framework would provide important insights regarding the relative magnitudes of costs associated with the

[4] For example see the *Rational Decision Model* and other examples in Jones (1994, p.39), the Institutional Analysis and Development Framework developed by Ostrom (1999) and general work to critique, refine and expand upon rational choice models as in Bell et al., (1988).

trade-off in question, it was not considered essential necessary to draw useful conclusions from application of the framework[5].

From a practical perspective, the choice to apply the framework to a single case study limited the author's ability to make generalizations about whether the findings may be applicable to other similar cases. However, the author tried to address this issue by employing a combined case study approach using both causal process tracing and congruence analysis methods.

A further important practical limitation of the case study approach employed in this research was the reliance on secondary data sources to produce the analysis. While, as stated above, there is a rich documentary history pertaining to the 2011 floods and the Thai Government's policy response, reliance on documentary sources excluded potential insights available from key actors and may have reproduced reporting biases. A related limitation was that the research drew only upon sources that were available in English. While translations were available for some key documents, it is likely that additional documentation on specific government deliberation processes available only in Thai would have had implications for the findings and analysis presented here.

1.6. Audience

It is anticipated that this research will be of substantive interest to policymakers responsible for developing adaptation policy; particularly those called upon to develop national level responses to extreme climate events. The research will also be of interest to researchers and research institutions working to understand the factors that lead to successful and unsuccessful adaptation policy interventions. Finally, this research may also be of interest to development organizations such as the ADB, World Bank, the Mekong River Commission, United Nations Development Programme, the United Nations Environment Programme and the Food and Agriculture Organization of the United Nations that work to build the capacity of policymakers to respond to climate change related threats and implement more effective adaptation policies; particularly in the water sector.

1.7. Outline

In the following section the explanatory framework is presented in detail. Section 3 provides the historical and policy context to the 2011 Thai floods and a brief introduction to the adaptation policy program that was adopted in response to the floods. In Section 4 the explanatory framework is applied to the case of the 2011 Thai floods and the findings analysed to determine what insights this case can provide about reactive adaptation, policy windows and extreme climate events. This is followed by discussion of the implications of this research and potential further insights that could be gained by combining this method with other relevant theories of policy development and governance. In Section 6, the thesis concludes with a brief reflection on the potential implications of this research for improving reactive adaptation policy developed in response to extreme climate events.

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[5] For example, see qualitative assessments of transaction costs presented in Birner & Wittmer (2004); Roggero (2013); Thiel & Egerton (2011); Thiel (2014).

2. Efficiency of Reactive Adaptation in response to Policy Windows resulting from Extreme Climate Events: An Explanatory Framework using Transaction Costs

As noted in the previous section, with this thesis the author aimed to investigate why reactive adaptation in response to policy windows opened by extreme climate events may result in poor adaptation outcomes from a cost and efficiency perspective. This investigation was conducted using an explanatory framework based on concepts related to policy efficiency, new institutional economics and transaction costs. While there are a number of limitations associated with the simplification of complex processes into an abstract framework, the value of attempting to establish a framework is to test theories and, in the context of this research, provoke further consideration of the nature of reactive adaptation and the special case of policy windows. Ultimately, the insights that can be inferred from the framework may help to improve future government responses to extreme climate events.

The explanatory framework used is explained as follows. Firstly, the theory of policy windows is elaborated to illustrate how the occurrence of an extreme climate event can lead to a trade-off between reactive adaptation and a status quo or 'do nothing' approach. This trade-off is then defined in terms of the full costs associated with each option. Following this, attention is directed toward the biological/physical and institutional context in which adaptation takes place and how drivers of policy windows may influence policymakers' estimates of the costs associated with the trade-off. Finally, the framework is used to put forward reasons why reactive adaptation in response to extreme climate events is more likely from a cost and efficiency perspective and how such reactive adaptation may lead to unanticipated costs and inefficient outcomes.

2.1. Policy windows and efficient adaptation: A cost trade-off

Before examining the costs involved with reactive adaptation to an extreme climate event, it is useful to consider how policy windows form to create a decision situation that implies a cost trade-off. Climate change adaptation is just one of many items that may be vying for attention on a government's agenda. Due to resource limitations only a limited number of items on the government agenda can be considered important enough at any one time to require decisive action. Policy windows can thrust an issue from simply being on the government agenda to requiring a decision to allocate resources.

Policy windows are created by the convergence of three 'streams' of policymaking that otherwise flow largely independent of each other (Henry, 2007). These streams are named *Problems*; *Political*; and *Policy*. The Problems stream is associated with the attention that the public and policymakers direct to a particular societal problem. The existence of a problem can be magnified by the presence of a focus event such as a natural disaster or extreme climate event. The Political stream is concerned with the way that policy stakeholders bargain or negotiate to form the government's agenda. The Policy stream comprises the list of alternative options that are available to resolve a particular problem (Kingdon, 1995). During the convergence that leads to the opening of a policy window a problem is recognized, a

policy solution is present and coupled with the problem and the political climate reduces constraints to action.

Extreme climate events create facilitate the opening of policy windows that give way to an adaptation response. These events strike in the problem stream drawing public and political attention to issues associated with an unpredictable and, possibly, changing climate. Often a range of potential adaptation policies or measures will be available and ready to couple with the problem at hand. Finally, the magnitude and duration of a particular event will influence the level of political negotiating and bargaining that will be required to facilitate action. The larger the impact of the event and the longer its impact draws on will increase the likelihood that policymakers will decide to act.

The concept of coupling is important because it implies that questions of policy choice and decision-making do not necessarily follow a problem solving model. According to the theory of policy windows, policy development does not follow a linear progression from problem identification to the development of different policy options, evaluation and then implementation. In contrast, according to the theory of policy windows, potential policy options or solutions can exist for long periods of time floating in and around government searching for problems to attach themselves to or political events that increase their likelihood of adoption (Kingdon, 1995).

Once this coupling occurs, governments face a trade-off[6] involving whether or not to act and commit the necessary resources. This trade-off will be complicated by the time-bound nature of the convergence that leads to a policy window being opened. Policy windows close for a number of reasons. These reasons could include the passing of the focus event or problem in question or that certain actions preclude others (Kingdon, 1995). Thus, while policy windows are rare and may be an opportune time to couple solutions with problems, their appearance does not necessarily mean that action is inevitable. This time bound nature of the policy window is crucial because it implies that taking advantage of a policy window will naturally entail consideration of the costs and benefits of action in response to the open window as opposed to inaction and a missed opportunity. This is a fundamental concept that underpins the explanatory framework developed in this thesis.

For the purpose of this thesis it is argued that it is useful in the context of policy windows that open in response to extreme climate events to consider this simple trade-off between adopting an adaptation policy program in response to such an event and choosing to do nothing. This implies that a policy window is opened by an extreme climate event and potential adaptation solutions have been identified and bundled into a policy program through a process of coupling. What remains is for policymakers to decide whether or not to commit the resources required or let the window lapse. To assist in evaluating this trade-off policymakers' could call upon a range of evaluation criteria relevant to adaptation policy

[6] For the purpose of this thesis, a 'trade-off' is defined as 'a situation in which you must choose between or balance two things that are opposite or cannot be had at the same time (Merriam-Webster Dictionary, 2014).' Applied to the situation at hand, this trade-off requires policymakers to choose whether or not to adopt an adaptation policy program in response to an extreme climate event. This implies that once the resources for a response are committed and the response implemented they cannot be recouped.

programs such as effectiveness, equity, legitimacy and efficiency. In choosing efficiency as the evaluation criteria, policymakers will invariably need to consider the costs of action and inaction.

As noted previously, in an efficiency context a policymaker considers whether the actual or anticipated results from a given policy response are justified by the resources required to achieve them (Mickwitz, 2003). When deciding whether or not to adopt a particular policy response policymakers must weigh the costs associated with the trade-off. Policymakers will perceive the opportunity cost trade-off associated with whether or not to adopt an adaptation response as the costs of inaction as opposed to the costs involved with the policy program in question. The option that results in less overall cost will be considered a more efficient use of scarce resources and, therefore, preferred. The trade-off is dynamic in the sense that estimates of cost may change in response to the specific features of an event or policy window. Thus, at a given point in time the cost trade-off between adaptation action and inaction could be expressed as one of the following relationships:

$$C_A < C_N \quad (1)$$

$$C_A > C_N \quad (2)$$

$$C_A \approx C_N \quad (3)$$

Where:

- C_A = The cost of designing and implementing an adaptation policy program in response to an extreme climate event; and
- C_N = The cost of inaction or doing nothing in response to an extreme climate event.

2.1.1. Costs of Adaptation

Adapting the framework developed by Birner & Wittmer (2004) to assess transaction costs associated with different natural resource governance structures and the design of management plans to produce environmental goods, the full cost involved with designing and implementing an adaptation policy program to an extreme climate event could be formulated as:

$$C_A = (T_D^a + F_D^a) + (P^a + T_I^a + F_I^a) \quad (4)$$

Where:

- T_D^a = Decision-making or policy design transaction costs, which are defined as the costs associated with making the decision to adopt a particular adaptation policy program in response to an extreme climate event;
- F_D^a = Decision failure costs, which are defined as the costs resulting from sub-optimal decisions in the design of the adaptation policy program;

- P^a = Production costs associated with adaptation measures, which are defined as the costs of establishing an adaptation policy program and related measures in response to an extreme climate event – production costs are also referred to as transformation or abatement costs in the literature (Garrick, Whitten, et al., 2013);

- T_I^a = Implementation transaction costs, which are defined as the costs associated with implementing decisions concerning the adaptation policy and related measures adopted in response to an extreme climate event; and

- F_I^a = Implementation failure costs, which are defined as the costs resulting from implementation problems that lead to a deviation from adaptation goals related to a particular adaptation policy program.

2.1.2. Costs of Inaction

The full costs of inaction in response to an extreme climate event could be thought of as the benefits forgone from not adopting the adaptation policy program plus the transaction costs associated with maintaining the current level of adaptive capacity or resilience to a particular climate event. Again, adapting the framework of Birner & Wittmer (2004), the cost of inaction in response to an extreme climate event could be formulated as:

$$C_N = O^n + T_I^n + F_I^n \quad (5)$$

Where:

- T_I^n = Implementation transaction costs of inaction, which are defined as the costs associated with maintaining the existing system to adapt to and/or respond to climate change and related threats;

- F_D^n = Implementation failure costs of inaction, which are defined as the costs resulting from loss and damage due to inadequate levels of adaptive capacity or resilience prevailing in the current management system; and

- O^n = Benefits forgone from not adopting an adaptation response to a particular extreme climate event.

2.1.3. The cost trade-off

Taking account of the discussion presented above the cost trade-off as perceived by policymakers presented in equations (1), (2) and (3) can be reformulated as:

$$(T_D^a + F_D^a) + (P^a + T_I^a + F_I^a) < (O^n + T_I^n + F_I^n) \quad (6)$$

$$(T_D^a + F_D^a) + (P^a + T_I^a + F_I^a) > (O^n + T_I^n + F_I^n) \quad (7)$$

$$(T_D^a + F_D^a) + (P^a + T_I^a + F_I^a) \approx (O^n + T_I^n + F_I^n) \quad (8)$$

Again, as noted above, policymakers will act upon these trade-off scenarios based on an assessment of the relative costs associated with each at any one point in time. The

explanatory framework developed here aims to better understand how the specific features or adaptation drivers of policy windows encourage policymakers to overlook or underestimate the costs involved in this trade-off increasing the likelihood that reactive adaptation will be adopted. Before examining this phenomenon in more detail it is useful to further define the different cost terms outlined in the trade-off above.

2.2. Types of cost involved in the design and implementation of adaptation policy

In order to evaluate the cost trade-off associated with policymakers' decisions regarding whether or not to adopt an adaptation policy program in response to an extreme climate event, it is necessary to have an understanding of the types of costs involved. In the trade-off above three broad types of cost have been presented; namely transaction costs (decision-making and implementation); production or transformation costs; and decision and implementation failure costs. These cost typologies are outlined below before being discussed in more detail.

Transaction costs arise from the difficulties associated with allocating resources to define, establish, maintain, use and change institutions and organizations and resolving the problems that these institutions and organizations are supposed to solve (Marshall, 2013). Classifying and later quantifying these costs is important for efficient policy design (McCann et al., 2005). For the purpose of the explanatory framework, the transaction costs associated with the development and implementation of adaptation policy have been broken down into decision-making and implementation costs according to the framework adopted by Birner & Wittmer (2004). However, these designations can be improved upon by drawing on the significant literature dedicated to further specifying and deconstructing the transaction and other costs associated with environmental and adaptation policies and policy programs.

Aligning with the broad categories for decision-making and implementation costs defined by Birner & Wittmer (2004), Hanna (1995) distinguishes between *ex-ante* and *ex-post* transaction costs associated with policy program development and implementation. Challen (2000) highlights the dynamic and static nature of transaction costs by differentiating between the institutional transition costs necessary to implement a new management policy and the static transaction costs necessary to maintain the policy after implementation. McCann et al. (2005) usefully categorized transaction costs according to the typical lifecycle phases of a policy program including: establishment of a baseline; development; early implementation; full implementation; and established program. Finally, Marshall (2013) built on the work of McCann et al. and Challen to identify the institutional 'lock-in' costs that may arise from trying to change or adjust institutional or policy arrangements associated with a particular institution or policy once it becomes established.

As noted above, other categories of cost will include production or transformation costs associated with specific measures and opportunity costs associated with adopting one approach over another. Using the specific example of adaptation in the context of complex social-ecological systems, Marshall (2013) delineated the different types of production costs associated with a particular institutional or policy arrangement into static and dynamic

transformation costs. Static transformation costs are associated with a status quo scenario, while dynamic transformation costs involve either technological transition or 'lock-in' costs depending on the approach proposed. Birner & Wittmer (2004) developed terms for decision and implementation failure costs to account for the opportunity costs associated with adopting a policy response. These latter costs will be discussed in more detail in the next section. The synthesis of these different cost typologies is presented in **Error! Reference ource not found.**. Having briefly synthesized the transaction cost literature it is now possible to specify the transaction cost variables included in the trade-off.

2.1.4. Decision-Making and Implementation Transaction Costs

Decision-making transaction costs can be thought of as *ex-ante* costs associated with the defining of a particular problem and designing a policy response (Hanna, 1995). In the scheme of transaction costs presented by McCann et al. (2005) these costs include 'research and information', 'enactment or litigation' and 'design and implementation'. The costs incurred here are associated with the need to propose, debate, negotiate and adopt a particular policy or institutional change (McCann et al., 2005). In this context 'design and implementation' refers more to the costs associated with adopting a policy rather than enacting a policy, although there is some overlap. These categories also include the costs required to acquire the information necessary to adopt a particular adaptation response and the costs of coordinating and accounting for the interests of the various stakeholders affected by the response (Birner & Wittmer, 2004). Challen (2000) highlighted that decision-making transaction costs are dynamic costs or those incurred as a result of provoking some form of institutional change. As noted above, policy decisions regarding the environment and natural resource management are generally collective action problems.

Action that results in benefit for one party to a collective action problem may have unintended and/or opposite effects on another (Birner & Wittmer, 2004; Marshall, 2013). This potential for externalities in the provision of collective goods or services increases with the number of stakeholders who will benefit from the good or service in question (Marshall, 2013). Trying to address the concerns of an increasing number of stakeholders involved in a decision-making process will tend to increase decision-making costs (Marshall, 2013; Roggero, 2013). Symmetrically, reducing the number of stakeholders consulted during a decision-making process will likely reduce decision-making costs, but may result in other unintended consequences (Roggero, 2013). McCann et al. (2005) note that some costs may be positively (complements) or negatively (substitutes) correlated with each other. Birner & Wittmer (2004) posit that in general, decision-making processes that aim for reduced transaction costs by neglecting stakeholder consultation will result in increased implementation costs.

The transaction costs of implementation comprise the costs of enacting a given policy response as well as the regulatory costs required for stakeholders to comply with and monitor a particular adaptation program. Alternatively, these costs can be thought of as the *ex-post* costs corresponding to program implementation and enforcement (Hanna, 1995). McCann et al. (2005) distinguishes between three stages of implementation.

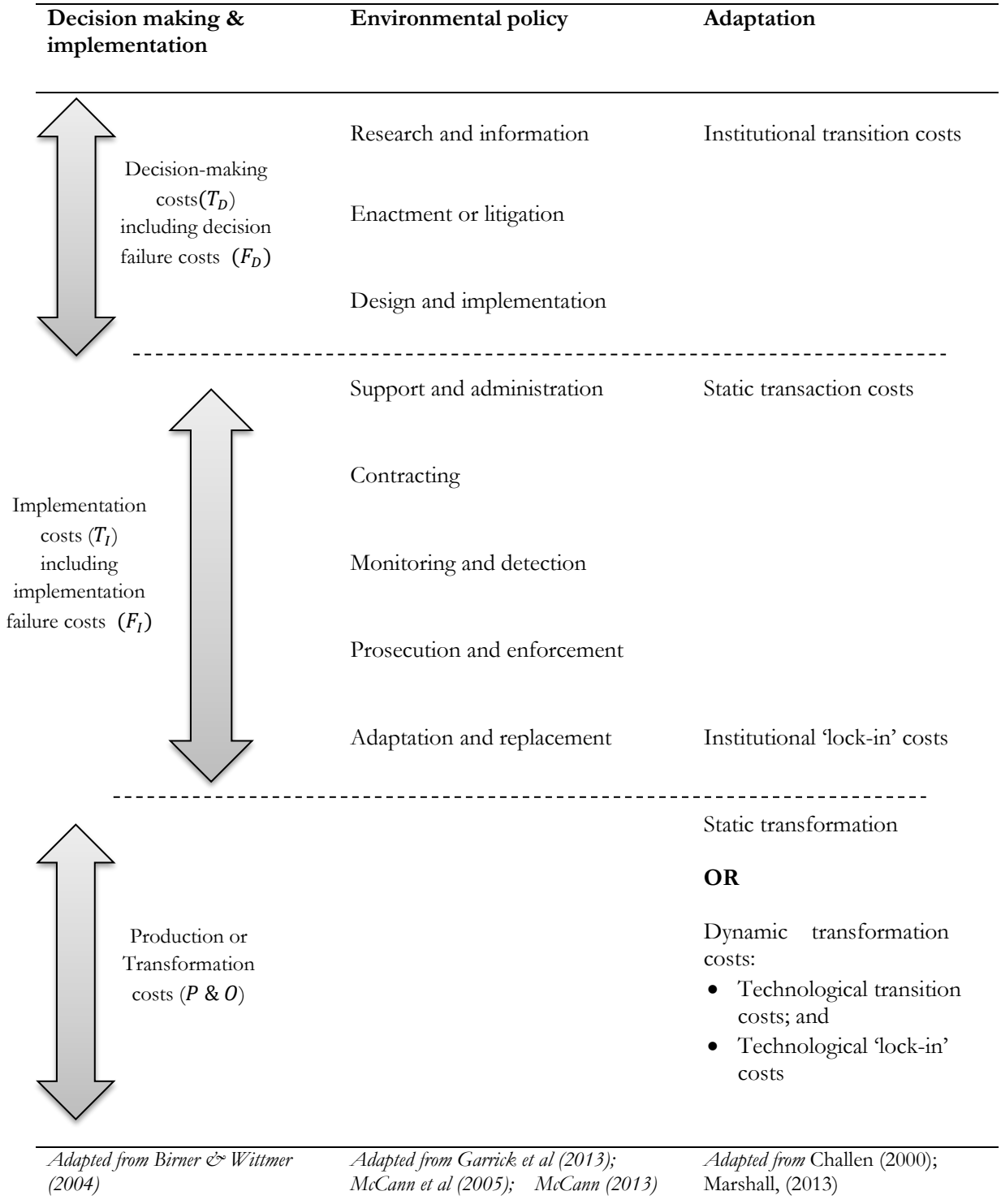

Figure 2-1 Synthesis of transaction cost typologies presented in the literature used for this thesis

Based on Garrick et al. (2013) and Marshall (2013)

Early implementation costs arise from the need to design administrative rules, hire staff or contractors to implement policies and measures and respond to the concerns of affected groups. As noted above, there is some overlap here with the decision-making costs described above. During full implementation policies are put into effect and costs arise to establish and administer contracts, monitor their progress, detect any deviations and enforce if necessary. Many of these costs continue as the program passes into the 'established' stage of implementation. Returning briefly to the trade-off described in the previous section, these costs are most readily associated with the implementation transaction costs of inaction. This is because any management system in the absence of a new policy still requires some level of monitoring and compliance cost.

Marshall (2013) made the important addition of adaptation and replacement costs, which represent constraints to future adaptation in response to environmental changes due to path dependencies embedded in the policy system over time. These constraints can be thought of as institutional 'lock-in' costs and include vested interests that benefit from the maintenance of the status quo.

2.1.6. Production or Transformation Costs

Production or transformation costs refer to the costs associated with producing a desired environmental good or abating or mitigating a negative environmental impact. These costs associated with effecting changes to on-the-ground technologies and practices can also be defined as dynamic transformation costs (Challen, 2000; Marshall, 2013). Marshall (2013) delineates these costs into technological transition costs and technological 'lock-in' costs.

Technological transition costs can be thought of as the costs of changing from prevailing technologies or practices to those associated with the policy or measures to be adopted (Marshall, 2013). Sometimes the distinction between these costs and transaction costs may be unclear. For example, policy changes or programs that rely mostly on procedural or administrative changes and measures such as programs to establish emissions or water trading schemes will generally only involve transaction costs associated with the exchange of permits and monitoring and enforcing the scheme. In some cases however, such as the construction of water control infrastructure or facilities for climate monitoring and modelling, the distinction is much clearer.

Marshall (2013) refers to technological 'lock-in' costs as those costs that arise from the difficulties with fully reversing the technological choices associated with an institutional or policy change. For example, action oriented adaptation policies that involve significant hard infrastructure such as dams, reservoirs and flood ways will usually be more costly to adapt or reverse than policies that focus on building adaptive capacity to climate related threats through the provision of improved climate monitoring and management plans. Technological 'lock-in' costs, like the institutional 'lock-in' costs described earlier above, attempt to account for the path dependencies that are embedded in particular policy choices and the fact that the range of viable future policy options is often influenced by past choices (Garrick, Whitten, et al., 2013; Marshall, 2013).

As noted above, in the context of the explanatory framework presented here, the costs of inaction also include the benefits forgone from not adopting an adaptation response to a particular extreme climate event. This is similar to the concept of static transformation costs in the typology presented by Marshall (2013). The benefits foregone represent the lost benefits that could have been gained by adopting an adaptation response reduced by the extent to which the action also may increase the vulnerability of certain groups – otherwise known as maladaptation (Barnett & O'Neill, 2010). Policymakers' perceptions of the benefits foregone may be influenced by the availability of incidences of loss or damage arising from extreme climate events.

2.1.7. Decision and Implementation Failure Costs

The decision and implementation failure terms included in the framework are not explicitly included in the transaction cost typologies specified by Garrick, Whitten, et al. (2013), Marshall (2013), McCann et al. (2005) and McCann (2013). Birner & Wittmer (2004) included these costs to capture the idea that there are trade-offs between the resources spent to reach a decision or implement a decision and the quality of the decision and measures implemented (Birner & Wittmer, 2004). In an adaptation context, decision failure costs can be equated to external costs that arise when a decision is reached that negatively impacts the interests of a stakeholder affected by an adaptation decision. For example, this could be equated with the resources that a community group might expend to oppose a decision to construct flood protection infrastructure that results in the permanent inundation of their community.

Implementation failure costs can be equated to the damage that results after the implementation of an adaptation response, which does not fully mitigate the climate threat it is designed to address. The implementation failure costs of inaction are taken here to represent the loss or damage which results from the occurrence of a particular climate event under the current management system in absence of new adaptation policies or measures. Drawing on theory and methods from climate risk literature, this cost could be thought of as a simple function of the damage costs associated with a current or recent climate event and the possibility that it will occur again in the future (see Brooks, 2003; Kunreuther et al., 2004).

2.1.8. Challenges associated with Quantifying and Measuring Costs

Although with this thesis the author produced only a qualitative assessment of the cost categories discussed above, it is necessary to discuss issues associated with quantifying and measuring these costs as they can influence the way that policymakers perceive the costs involved in any policy trade-off. This is because when policymakers consider an adaptation trade-off they need to have both an understanding of the types of cost involved and at a minimum some idea of their potential magnitude.

Following on from work by Garrick, Whitten, et al. (2013), Marshall (2013), and McCann et al. (2005) it is proposed that, despite some practical difficulties, each of the cost terms associated with the trade-off discussed in the previous section can be estimated, quantified and/or measured and expressed in a common unit of value consistent with methods associated with cost-benefit analysis, cost-effectiveness and similar policy evaluation methods (see Mickwitz, 2003). As each cost term is concerned with costs accumulated over time or

incurred at some point in the future it is important to note that each of these costs would need to be discounted to some common temporal unit of value[7]

However, while recent transaction cost literature has made considerable progress in suggesting ways that some of the costs identified in the previous sections can be measured and quantified; there are a number of inherent and persistent challenges with quantifying these costs that are relevant for the subsequent analysis presented in this thesis. Generally, the data required to quantify these costs is often not recorded (McCann et al., 2005). As a result, transaction costs need to be estimated using proxy values or based on the recollections of government employees. Costs associated with decision failure are difficult to quantify because to estimate these costs accurately information on the preferences of each stakeholder affected by a particular adaptation action would need to be known and considered. Often the range and diversity of stakeholders involved in collective action problems and adaptation is too great to accurately estimate, let alone measure, the external costs of poor decision-making. Useful proxy values may be the costs borne by stakeholders to oppose a given decision and associated costs resulting from the delayed implementation of a given policy. However, this will not capture the external costs experienced by all stakeholders and will tend to be concentrated with those groups who are most affected by a particular policy (Marshall, 2013).

The difficulties in estimating costs associated with implementation failure arises due to the natural uncertainty that comes with, firstly, understanding potential future climate changes and predicting the future incidence of extreme climate events and, secondly, foreseeing whether and to what extent the adaptation measures under consideration can actually mitigate loss and damage arising from a particular type of climate event. Similar challenges are involved with estimating other costs associated with future, unforeseeable circumstances including benefits forgone and institutional and technological 'lock-in' costs (Marshall, 2013).

2.1.9. Complications arising from the timing of decisions and the availability of cost information

As alluded to above, the sequencing of transaction costs is also important because it will affect how and when these costs are quantified. McCann et al. (2005) highlighted that the information to more accurately quantify transaction costs will be available at different times over the policy development and implementation process. As a result, during different stages of the policy process policymakers will have to make ex-ante assessments of costs, which may be able to be later quantified using evidence flowing from the implementation process. This is particularly important in the context of extreme climate events and policy windows because decisions regarding whether or not to adopt a particular policy response will necessarily be based on an ex-ante assessments of the relative costs involved. Ex-ante assessment of costs invariably results in reliance on estimates, proxy values and perceptions that will more likely overestimate or underestimate the actual costs involved.

[7] See Kull et al. (2013) and Pearce (2002) for discussion of how the process of discounting applies in the context of policy evaluation.

A related complication is that the concept of policy windows implies that the cost trade-off described in the explanatory framework takes place at a fixed point in time. This could result in an expectation that decision-making costs are those costs incurred only before this point and implementation costs only afterwards. However, in reality decisions regarding the make-up of a given policy program may occur intermittently over different decision-making and implementation phases. Thus, in applying the framework it is important to distinguish between the phases of policy development and implementation and when transaction and other costs occur. McCann et al. (2005) note that phases of the policy process often overlap and that costs may not be incurred sequentially.

Given these issues, the cost trade-off embedded in the explanatory framework should be interpreted as a relationship between a set of temporally aggregated terms that can be estimated at a given point in time based on the information available. While estimates of the costs involved with the trade-off may improve in accuracy over time, the estimates available to policymakers at the time the policy windows opens will generally be considered more consequential as they are likely to have the strongest bearing over whether or not action is adopted. While it is possible that later evaluations of the cost trade-off may result in changes to the detail of the program in question and also the way that certain costs are managed, it is considered unlikely that they would halt or terminate its implementation – except in extreme cases.

2.1.10. Contextual factors that influence costs

The cost trade-off described above is further complicated by the fact that it does not occur in a vacuum. A range of physical, biological and technical factors will influence estimated and actual production and transaction costs, which ultimately affect how policy solutions are coupled with problems and whether action is ultimately taken in response to a given problem (Birner & Wittmer, 2004; McCann, 2013; O. Williamson, 2000). These factors can relate to the nature of resource system for which a policy is being considered, the institutions responsible for maintaining and managing the system, the technological and policy options available to address a given problem, and the specific features of the transaction or production costs incurred to give effect to a given policy decision (Birner & Wittmer, 2004; Coggan et al., 2010; Garrick, Whitten, et al., 2013; McCann, 2013; Ostrom, 1999, 2009; Roggero, 2013; O. E. Williamson, 1998; O. Williamson, 2000). A policy development and implementation process will also be influenced by the nature of the transactions involved to develop and implement the policy program in question (Coggan et al., 2010; Garrick, Whitten, et al., 2013; O. E. Williamson, 1998; O. Williamson, 2000).

McCann (2013) developed a comprehensive account of these factors drawing on a wide body of environmental policy and transaction cost literature. The different factors are separated into physical/biological and institutional factors and then further broken down according to whether and to what extent each factor is amenable to change. This last characteristic is added to provide an indication of the extent to which these factors will persist in a given policy context. Those factors more amenable to change may be able to be counteracted or harnessed to influence costs through policy design.

Table 2-1 Physical/Biological Factors that influence a Policy Cost Trade-off

Factors	Implications
Least amenable to change	
Global vs local problem	• Policymakers will generally have more capacity to address problems at the local level and should target action accordingly
Scale	• Larger scale problems will require more resources and coordination
Time lags	• Lags between when a policy decision is adopted and when the benefits of the decision will be realized will influence the level of support for action
Somewhat amenable to change	
Magnitude of change needed	• The amount of change needed to address a particular problem will influence its acceptability
Heterogeneity	• Problems with multiple dimensions and impacts are more difficult for policymakers to address effectively
Excludability	• Environmental goods are typically non-excludable requiring higher negotiation, monitoring and enforcement costs
External effects	• Policies with many external effects generally require the involvement of more stakeholders in decision-making and higher negotiation costs
Private vs. Private costs	• How costs are experienced by public and private actors will affect the types of policy response considered
Measurability/Observability	• The extent to which a system is observable and any change in the system is measurable will affect, the types of policies that are feasible or acceptable
Economies of scale/scope	• Certain problems or situations may reward combination of activities to take advantages of economies of scale
Number of agents involved	• Larger number of agents involved in a process and the frequency with which they are required to transact will be positively correlated with cost
Uncertainty	• Uncertainty results in incomplete policy options and transactions increasing *ex-post* transaction costs
Asset specificity	• If a policy results in the deployment of a specific asset that cannot be easily redeployed opportunity costs may be involved
Amenable to change	
Technical change	• Adopting a particular technological response may result in 'lock-in' and opportunity costs

Adapted from McCann (2013)

A summary of the physical/biological factors and their implications for environmental policy-making is provided in Table 2-1. A similar summary of factors related to the institutional environment is provided in Table 2-2. Each of these factors will influence the magnitude of the cost variables identified above and policymakers' estimates of the cost trade-off associated with the decision to adopt an adaptation program in response to a given

extreme climate event, or not. For a given policy problem, each of these factors will manifest themselves at different institutional, spatial and temporal levels. In this sense, a policy process developed to address a specific problem is nested within a given physical/biological, institutional and temporal context.

Table 2-2 Institutional Factors that influence a Policy Cost Trade-off

Factors	Implications
Least amenable to change	
Culture with trust, social capital	• Culture with high levels of trust require less cost to negotiate policy responses
Institutional environment - Democracy - Effective legal system - High level of proof	• Effective legal systems and democratic principles can reduce the costs required to design and implement a policy response
Somewhat amenable to change	
Physical and administrative boundaries	• Policy development processes involving institutions that overlap or are poorly defined will involve more cost
Lobbying	• Lobbying may lead to policy decisions that favour certain groups and increase external effects
Property rights	• Policies that assign or create new property rights will involve transaction costs and may also involve distributional issues
Market structure	• Whether a policy draws upon an existing market or creates a new market will involve different levels of cost
Existing laws and legislation	• The nature of existing laws may affect the magnitude of effort or cost need to alter or reverse them
Amenable to change	
Sequencing and timing	• How policies and measures are sequenced will affect costs
Behavioural economics	• The extent to which stakeholders do not respond to policies as anticipated may increase costs
Intermediaries	• The use of intermediaries may reduce transaction costs

Adapted from McCann (2013)

In general, addressing the impacts of climate change involves high levels of uncertainty, which leads to significant cost. Specifically, there is a great deal of inherent uncertainty with predicting the occurrence of extreme climate events. This uncertainty will naturally increase research costs associated with measures aiming to prevent or mitigate the impact of such events. The impacts of climate change and the effectiveness of measures to address them are sometimes difficult to observe or measure. Monitoring and enforcing a given policy or measure will therefore likely involve higher levels of traction cost. Uncertainty regarding whether an event may or may not occur again in the future also affects the opportunity costs associated with using resources to tackle a problem based on past experience. Adaptation action to address such events usually involves time lags meaning that the benefit of an action

may not be realized until some point in the future. This naturally results in higher levels of opportunity cost. When policymakers invest in adaptation action today they divert resources from other potential policy measures that could deliver immediate, tangible benefits for constituents.

The summary effect of these factors will make adaptation policy difficult to design and implement. It is therefore reasonable to expect for the reasons outlined above that the transaction and other costs associated with an adaptation policy program will be relatively high. However, policy windows work in such a way that encourages policymakers to overlook or underestimate the influence of these factors and the attendant costs.

2.1.11. How policy windows influence assessment of adaptation cost-trade off following an extreme climate event

In the incidence of an extreme climate event such as a flood that involves high levels of socio-economic damage, the 'policy window' hypothesis supposes a number of drivers will emerge to make reactive adaptation more likely. These drivers, which are identified in Table 2-4, will tend to obscure the complexity of the physical/biological and institutional context surrounding a particular policy evaluation process. In the context of the framework developed here, it is posited that these drivers may work to encourage policymakers to overlook or underestimate the transaction and other costs involved in a given cost trade-off. Subsequently, this can lead policymakers to make incorrect or unfounded judgments about the cost and efficiency of an adaptation policy response to an extreme climate event.

Looking firstly at the costs of inaction, policymakers' ex-ante estimates of this alternative will be strongly influenced by the loss and damage that results from a given extreme climate event. Due to the catastrophic nature of extreme climate events it is likely that these costs will be high. These implementation failure costs of inaction (F_I^n) associated with the inadequacy of the current prevailing adaptation system may also be magnified due to the availability of a recent extreme climate event as there may be increased anticipation of a similar event in the future despite estimates of return periods. While the probability of an extreme climate event occurring in a given year is usually low (Kull et al., 2013), the recent incidence of an event may cause policymakers to treat it as a default case on which to base their consideration of the costs of inaction. While the management costs of the current system (T_I^n) may be available, pressure to act and reduced timeframes for decisions and action may result in them being omitted from the cost trade-off. The extent to which any existing infrastructure has been damaged or lost may reinforce perceptions that prevailing policies or systems are inadequate and need to be changed.

The benefits forgone (O^n) of not adopting some form of response are more difficult to quantify and are unlikely to be considered explicitly as part of the adaptation cost trade-off. However, the heightened awareness of the costs of the prevailing system will likely inflate perceptions of the benefits forgone from not adopting an adaptation response. This effect may be compounded by political or public pressure for the government to respond to a given crisis. To the extent that policymakers feel pressure to respond, it may increase their perceptions of the costs of forgoing a given opportunity to act and pursue a particular

adaptation response, which may subsequently drive up the estimated costs of inaction. A summary of the effect of policy windows on the different costs of inaction is presented in Table 2-4.

Table 2-3 Adaptation drivers of policy windows arising from extreme climate events that increase likelihood of reactive adaptation

Adaptation driver	Description
New awareness of risk after an extreme event leads to consensus	The experience of the event is expected to generate new knowledge, which will encourage stakeholders to come together to address future risks.
Problems with prevailing policies are revealed	An extreme event may lead to a heightened awareness of problems with the status quo, which could encourage action to address them.
Institutional weaknesses are exposed	Poor government and institutional responses to an extreme event expose these stakeholders to greater scrutiny during and immediately after an extreme event. This may facilitate action on the part of these groups.
Old vested interests are weakened	The influence of stakeholders whose actions have contributed to creating risks may be reduced allowing for dramatic action and new approaches.
External stakeholders are 'reminded' or 'reacquainted' with risks	Extreme events draw greater attention from external stakeholders such as foreign investors and foreign governments and relief agencies that may increase pressure to act.
Existing infrastructure lost or damaged	An extreme event may result in the loss or damage of existing infrastructure that needs to be replaced and perhaps strengthened.
Enhanced political will	The combination of the factors outlined above can lead to enhanced will to act to address a particular type of event or risk and more proactive political leadership on a particular topic.
Money becomes available to do things better	In response to an extreme event it is more likely that reconstruction funding is made available to address future risks.

Adapted from Christoplos (2006)

The costs of action will generally be linked with estimates of the production or transformation costs (P^a) associated with the given adaptation policy program. While these will generally be the easiest costs to quantify, they may still be influenced by the drivers described in Table 2-3. For example, pressure to respond to a crisis and enhanced political will may encourage advocates of a particular response to overlook or underestimate the attendant costs. If measures are designed quickly without time to verify estimates of production costs there may also be increased likelihood that costs are underestimated or overlooked. Policy programs that involve hard infrastructure measures will also involve

certain levels of technological 'lock-in' cost that may be overlooked during policy design and may not be recognized until after the measures have been implemented. Generally, reactive adaptation that involves significant path dependencies with high levels of technological 'lock-in' cost normally associated with large scale infrastructure is more likely to be maladaptive (Barnett & O'Neill, 2010).

Table 2-4 Summary of how Policymakers will estimate costs of Inaction in Response to an Extreme Climate Event

Cost Variable	Explicitly considered in cost trade-off?	Explanation in the context of policy windows hypothesis and extreme climate events
Costs of Inaction		
Implementation failure costs of inaction (F_I^n)	*Yes*	• Generally equated with estimates of loss and damage resulting from most recent extreme climate event • Often the only cost of inaction explicitly factored into the cost trade-off • Likely to be underestimated • Recent incidence of extreme climate event may raise anticipation of future loss and damage costs
Implementation costs of inaction (T_I^n)	*Possibly*	• Cost information will be available from existing policies or measures • But may be overlooked as part of the cost trade-off
Benefits foregone (O^n)	*No*	• Unlikely to be explicitly considered as part of cost trade-off • Very difficult to quantify • Heightened awareness of the weaknesses with the prevailing system will increase estimates of the opportunity costs of inaction

While some decision-making transaction costs (T_D^a) may be accounted for in production cost estimates, they could be underestimated. New awareness of the risks posed by extreme climate events, the exposure of institutional weaknesses, reduced influence of vested interests and perceptions of consensus for action, may create anticipation that formal opposition to action will be lower than normal and that transaction costs associated with negotiating and seeking support for policy action will be reduced. The presence of a policy window may also create the impression that costs necessary for research and information gathering related to proposed actions are diminished because temporary agreement on the need to act may tend to overshadow the inherent uncertainty involved with anticipating and addressing future climate events. Pressure to act from both internal and external stakeholders may also encourage policymakers to make short-cuts in policy design stages and defer key design decisions to later stages of the policy implementation process.

Table 2-5 Summary of how Policymakers will estimate Costs of Action in Response to an Extreme Climate Event

Cost Variable	Explicitly considered in cost trade-off?	Explanation in the context of policy windows hypothesis and extreme climate events
Costs of Adaptation		
Production or Transformation Costs (P^a)	*Yes*	• Generally equated with the cost estimate of a given policy program • Often the only cost of action explicitly factored into the cost trade-off • However technological 'lock-in' costs usually not considered • Likely to be underestimated
Decision-making Transaction costs (T_D^a)	*Possibly*	• Some costs may be integrated into production cost estimates • Anticipation that costs will be low because extreme event will reduce need for information and facilitate negotiation • Pressure to act may encourage policy design 'short-cuts' • May be underestimated
Implementation Transaction Costs (T_I^a)	*Possibly*	• Sometimes these costs will be integrated into production cost estimates • Otherwise they will be equated with status quo implementation costs or overlooked • May be underestimated
Decision Failure Costs (F_D^a)	*No*	• Unlikely to be explicitly considered as part of cost trade-off • Very difficult to quantify • Perception of consensus encourages policymakers to believe that support for action is shared and possibility of external effects are low
Implementation Failure Costs (F_I^a)	*No*	• Unlikely to be explicitly considered as part of cost trade-off • Very difficult to quantify • Overshadowed by consideration of loss or damage associated with the current extreme event

It is likely that the transaction costs of implementation associated with a response (T_I^a) will generally either be rolled into production costs or equated with the implementation costs of the prevailing system(T_I^n). In addition, enhanced political will to address the impacts associated with certain types of extreme climate events may increase the likelihood that action is perceived as inevitable. This combination of elements is likely to result in significantly lower perceptions of institutional 'lock-in' costs that may otherwise act as barriers to action.

Due to difficulties with estimation and perhaps because of their abstract nature, decision (F_D^a) and implementation failure costs (F_I^a) associated with adaptation action are not likely to be explicitly considered as part of any adaptation cost trade-off. However, policy windows could influence policymakers' impressions of these costs in important ways. In particular, consensus or the appearance of consensus may encourage policymakers to believe that support for action is widely shared and that potential costs associated with opposition a particular adaptation approach are much lower than under normal circumstances. Considerations of implementation failure (F_I^a) associated with action may tend to be overshadowed by policymakers' consideration of loss or damage associated with the current extreme event. A summary of the effect of policy windows on the different costs of action is presented in Table 2-6.

2.3. Explanatory framework applied to the context of policy windows and extreme climate events

2.2.1. Summary of explanatory framework

According to the explanatory framework, an extreme climate event leads to the convergence of the three policymaking streams – Problem, Policy and Political – to open a policy window that works to facilitate reactive adaptation. Through a process of coupling one or a number of adaptation policy options emerge from the policy stream to form a policy program that is matched with the political will to adopt it.

Whether the program is adopted or not depends on policymakers' assessment of the relative merits of the policy response as opposed to the status quo. This trade-off can be evaluated using a range of potential evaluation criteria. From a cost and efficiency perspective policymakers will be inclined to adopt the response that will involve the least overall cost. Thus, reactive adaptation is more likely to occur when the costs of action are estimated to be less than the opportunity costs of maintaining the status quo (Dinar & Saleth, 1999).

It is important to note here that although policymakers may estimate that a given response is less costly, it does not necessarily imply that it will automatically be adopted. The framework does not aim to make inferences about the relative importance of different evaluation criteria. However, evidence of the importance of different criteria will usually be available directly from the policymakers involved in evaluating a given trade-off or indirectly from public records or reports.

The full costs of action are equal to the transaction costs required to design and negotiate the program, costs to produce the desired adaptation good and opportunity costs resulting from a failure to properly account for the interests of all stakeholders or adopting poorly designed or unnecessary measures. The full costs of inaction are equal to the benefits forgone from inaction plus the implementation transaction and failure costs of the prevailing management system. These are temporally aggregated values that can be estimated at different points in time during the policy lifecycle based on the information available. However, the estimates available to policymakers at the time the policy window opens will generally be considered

more consequential as they are likely to have the strongest bearing over whether or not action is adopted.

A given policy window and the cost trade-off are themselves nested within a physical/biological and institutional context. Due to the complexity of adaptation problems that often require, amongst other things, extensive collective bargaining and involve high levels of uncertainty, it would normally be expected that the estimated costs of action are relatively high. As a result, it could be anticipated that the likelihood of adaptation action to address the incidence of a particular extreme climate event is low. However, the 'policy window' hypothesis supposes a number of adaptation drivers will emerge to make reactive adaptation more likely.

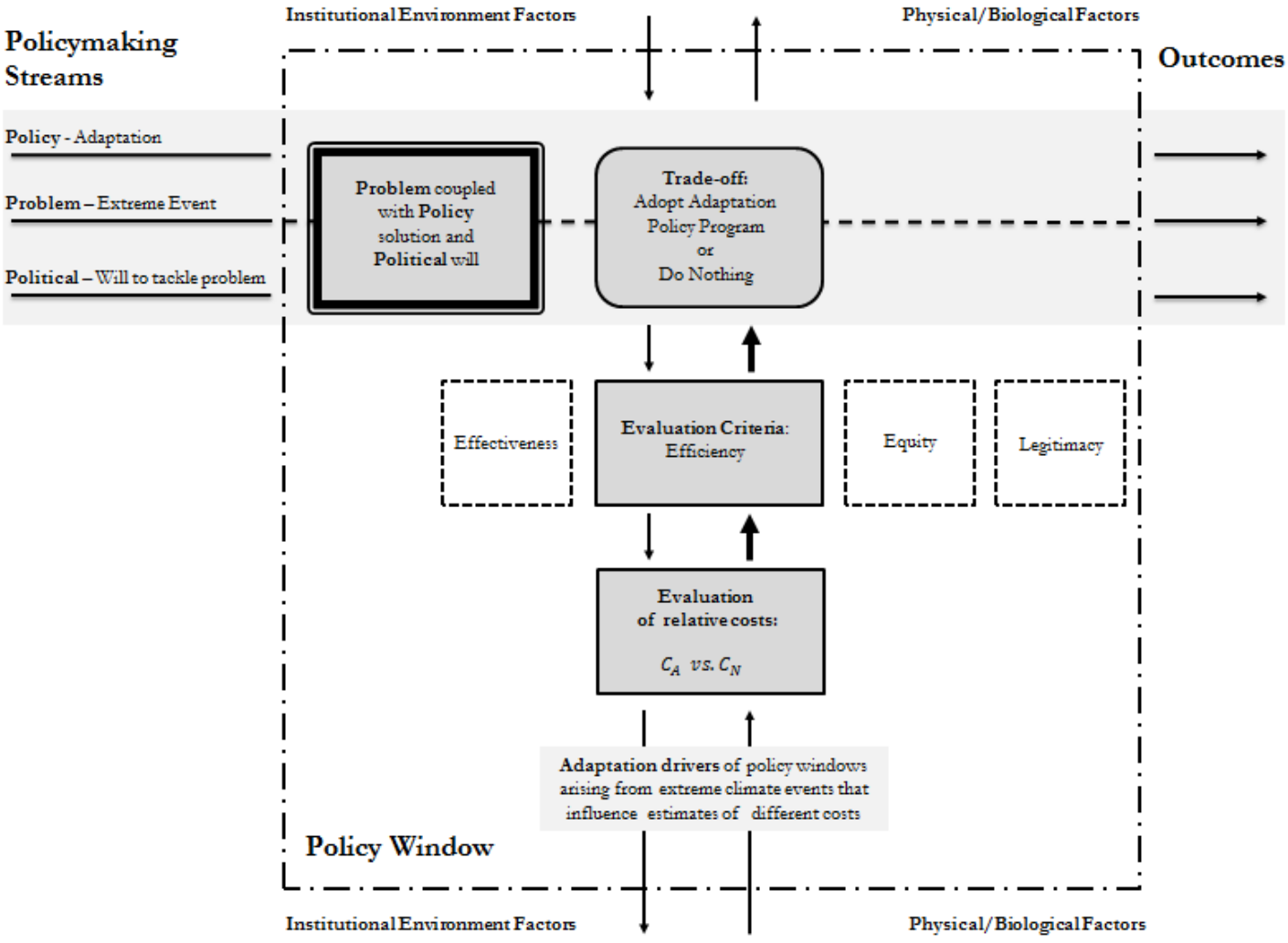

Figure 2-2 Visual summary of explanatory framework applied to extreme climate events

A visual overview of the applied explanatory framework is presented in Figure 2-2. The bold arrows in Figure 2-2 indicate the relative strength of influence of each element of the framework on the trade-off. For example, the adaptation drivers of policy windows that open in response to extreme climate events will have a strong influence on the ex-ante evaluation of the relative costs associated with adopting an adaptation program or doing

nothing. Similarly, the findings of the evaluation according to the chosen criteria will have a similarly strong influence on the final trade-off. However, due to the nature of policy windows and the influence of specific factors associated with them, the influence of the physical/biological and institutional context on the estimates of cost involved in a given trade-off may be weakened.

2.2.2. Why reactive adaptation is likely in response to extreme climate events from a cost and efficiency perspective

Now that the different elements of the explanatory framework are better defined it is possible to apply it to gain insight into why, from a cost and efficiency perspective, reactive adaptation happens in response to extreme climate events. Because of difficulties with estimation and their abstract nature, the costs of action resulting from decision and implementation failure may be overlooked. Similarly, it is likely that the benefits forgone from not adopting a response to a given extreme climate event may not be explicitly considered as part of the adaptation trade-off. As a result, policymakers may conceive the costs of adaptation and costs of inaction as:

$$C_A = T_D^a + P^a + T_I^a \quad (9)$$

$$C_N = T_I^n + F_I^n \quad (10)$$

In addition to overlooking certain costs, the adaptation drivers of policy windows arising from extreme climate events may encourage policymakers to underestimate the transaction required to adopt an adaptation policy program. Due to the catastrophic nature of extreme climate events, the costs associated with loss and damage and implementation failure arising from the of the prevailing adaptation system are likely to be relatively high compared to the estimated production costs of a given policy program developed in response to the event. As a result, based on this crude and incomplete comparison of estimated costs, policymakers may decide that reactive adaptation as a response to a current or recent extreme climate event involves far less cost than maintaining the status quo. Subsequently, policymakers may be encouraged to evaluate the cost trade-off following an extreme climate event as follows:

$$(T_D^a + P^a + T_I^a) < (T_I^n + F_I^n) \quad (11)$$

Or

$$C_A < C_N \quad (1)$$

Thus, from an efficiency perspective, the presence of a policy window may increase the likelihood that adopting an adaptation policy program will, *ceteris paribus*, be considered more efficient than inaction increasing the likelihood that it will be adopted.

2.2.3. Reasons why policy windows lead to inefficient and sub-optimal adaptation outcomes

Drawing on the discussion in the previous sections, it is now possible to outline why, contrary to intuitive logic, reactive adaptation in response to policy windows may lead to

costly, inefficient and, ultimately, sub-optimal adaptation outcomes. Essentially, for the same reasons that action will be considered less costly in the context of a policy window, reactive adaptation can later result in unanticipated and significant costs.

Policy windows following extreme climate events may lead policymakers to overestimate stakeholder consensus for action and neglect necessary decision-making transaction costs increasing the likelihood of significant decision failure. Unfortunately, the decisions failure costs associated with collective action problems that involve high levels of uncertainty such as climate change adaptation are likely to be considerable (Hanna, 1995; Marshall, 2013). Mitigating decision failure normally involves extensive consultation and careful weighing, prioritizing and sequencing of different policy options (Christoplos, 2006). Careful attention to these processes that would minimize decision failure will usually be reflected in the time and resources dedicated to decision-making transaction costs for activities such as research, policy design and consultation. However, the presence of a policy window may encourage policymakers to fast-track, simplify or neglect these processes and defer more difficult decisions to a later stage of policy implementation. In such cases, it is likely that policymakers will manage decision-making transaction costs in a way that can lead to significant decision failure costs.

Poorly considered policies which are inadequately vetted with concerned stakeholders will be more likely to result in significant implementation transaction costs and implementation failure costs. These costs will be reflected in the form of legal challenges, formal policy reviews, protest and opposition to specific plans or measures. The devastating nature of extreme climate events and correspondingly high estimates of loss and damage may also encourage policymakers to overreact or overshoot in the design of a particular policy program. Policymakers may adopt measures that are designed for particularly rare events or measures that are not necessary to address the problem in question resulting in additional implementation failures and associated costs. Alternatively, policymakers may focus too intently on the extreme climate event at hand missing opportunities to strengthen resilience and reduce vulnerability to other climate-related problems.

For the reasons outlined above, the decision to adopt an adaptation policy program in response to policy windows arising from extreme climate events may lead to poor adaptation outcomes from a cost and efficiency perspective. In extreme cases, reactive adaptation that involves considerable decision and implementation failure as a result of underestimating or neglecting decision-making transaction costs may take on the form of maladaptation. In these cases, the adaptation response chosen results in significant opportunity costs. This implies that the resources invested to take advantage of the policy window could have been directed towards alternatives that deliver similar or better adaptation outcomes for similar or less cost (Barnett & O'Neill, 2010).

The adaptation drivers of policy windows and the way they shape estimates or perceptions of the adaptation cost trade-off mean that potential problems and inefficiencies go unrecognized until after a policy is adopted. Policymakers' initial evaluation of the cost trade-off will necessarily be ex-ante in nature. It occurs before resources are committed. While the elements of cost trade-off do not change over time, implementation will generate more cost

information to better estimate the actual costs involved. However, ex-post information on the actual costs and possible inefficiencies associated with a particular decision will often only start to emerge after key policy design choices have already been made and are more difficult to change. As a result, a detailed assessment of the cost trade-off based on more complete information is often not possible or sought after. This opens up the possibility that few lessons are learned and similarly inefficient processes are repeated.

While efficiency is the basis for the explanatory framework presented above, it is also worthwhile to briefly touch upon how the way in which policymakers react to the specific opportunities presented by policy windows may have important implications for other criteria such as effectiveness, legitimacy and equity. For example, policy programs that are designed without investing in costs for consultation and coordination during the decision-making process will likely result in poor legitimacy and reduced levels of equity. Similarly, adaptation policy programs that are designed without adequate consultation during their design are generally found to be more ineffective at achieving their stated adaptation outcomes (Adger et al., 2005; Few et al., 2006). In these ways inefficient adaptation policy decisions that may be characteristic of policies designed in response to policy windows and extreme climate events may also lead to other, sub-optimal outcomes.

To summarize, in this Section an explanatory framework has been developed to demonstrate how reactive adaptation in response to a policy window opened by extreme climate events may lead to poor adaptation outcomes from a cost and efficiency perspective. When applied to the particular context of policy windows and extreme climate events, the framework suggests that the way policymakers estimate and manage transaction costs during the decision-making process can influence the overall success of the response adopted. The adaptation drivers that work to facilitate action may also encourage policymakers to overlook and underestimate key costs. Failure to properly account for and manage the costs involved in the design of the adaptation policy program can lead to significant opportunity costs associated with delays and adjusting measures to better account for the concerns of neglected stakeholders.

Whether these theories and the explanatory framework from which they have been derived are verifiable and able to provide useful insight for policymakers charged with designing policy responses to extreme climate events needs to be tested using appropriate case studies. With this in mind, in the following Sections the explanatory framework is applied to the case of the 2011 Thai floods to further investigate the validity of the theories and framework developed here.

3. The 2011 Thai Floods and the Thai Government Response

The heavy precipitation and flooding that inundated a substantial portion of Thailand, and the Chao Phraya River Basin in particular, during the second half of 2011 was an extreme climate event that prompted a considerable policy response from the national Thai Government. As discussed further below, the response involved measures to both enhance the adaptive capacity of numerous groups to future flood events and construct flood control measures that were intended to reduce vulnerability to such events. To investigate issues surrounding reactive adaptation in response to extreme climate events in more detail, the author used the Thai Government's response to the 2011 floods as a case study. But to better understand the Thai Government's reaction to the floods it is useful to first review some features of flood in Thailand; particularly flood in the Chao Phraya River Basin and the specific circumstances surrounding the 2011 floods.

3.1. 2011 Floods historical and policy context

3.1.1. The Chao Phraya River Basin

The Chao Phraya River Basin is a complex social-ecological system (SES). As such it is comprised of a range of linking sub-systems including the resource (the basin itself), resource units (water volume, water quality), users (households, industry and agriculture) and governance systems (organizations and rules that govern use of the resource) (Ostrom, 2009). The basin itself is divided into upper, middle and lower sections (delta) and covers a third of Thailand's geographical area running from the country's northern border down to the Gulf of Thailand (Divakar et al., 2011; Komori et al., 2012; Molle, 2007). In addition to its considerable size, the Basin is also the most economically significant and populous geographical area in Thailand. Over the past century, rapid economic growth in the delta region and a shift toward irrigated cultivation practices has been accompanied by the emergence of a complex mix of urban communities and agricultural and industrial production systems along the Basin. The Basin is home to 20 million people (30 per cent of Thailand's population), 2.2 million hectares of irrigated land and a number of industrial estates (Gale & Saunders, 2012; Komori et al., 2012; Molle, 2007). To meet the water demands of agriculture, industry, and human populations, the Basin has been transformed with a system of water management infrastructure including a number of multi-purpose storage dams, reservoirs, dikes, pumping stations and irrigation canals (Divakar et al., 2011; Molle, 2007). This infrastructure has also served to try and mitigate the impact of flood (Hungspreug et al., 2000).

3.1.2. Water governance in Thailand

Governance is an important and complex feature of the Basin's socio-ecological system. The story of water governance in Thailand commenced in the 1950s when government planners started to recognize the value of water resources as a development tool to modernize agricultural communities in the northeast region of the country (Sneddon, 2002). Over the following decades Thailand developed a complex institutional framework for water

governance with numerous Ministries and line agencies responsible for various water management activities. As there is no overarching water law in Thailand these responsibilities are defined in numerous laws, which have tended to focus on the functional roles provided by different stakeholders. This has often resulted in the duplication of water management activities (ICEM, 2014a).

Figure 3-1 Eight key river sub-basins of the Chao Phraya River

Source: ArcGIS (http://www.arcgis.com/home/webmap/viewer.html?useExisting=1)

An important recent trend in water governance in Thailand has been the decentralization of water governance. Decentralization in the context of water governance aims to increase transparency and stakeholder participation in decision-making by involving water users or governments at the river basin level or below (Dinar et al., 2007). In Thailand decentralization has been attempted through the establishment of new regionally based water agencies and a network of River Basin Committees (RBCs). In the case of the Chao Phraya River Basin there are eight relevant sub-basins with individual RBCs including: the Ping;

Wang; Yom; Nan; Sakae Kraeng; Pasak; Tha Chin; and Chao Phraya sub-basins (Pavelic et al., 2012; Ti & Facon, 2001) (Figure 3-1). Recent research indicates that decentralization has so far been ineffective with power over water resources generally being retained in central government agencies at the national level (ADB, 2012; ICEM, 2014a; Molle, 2007).

3.1.3. Flooding in the Basin and the 2011 Floods

Flooding is a common natural phenomenon in the Chao Phraya River Basin due to the interplay of a number of geographical and climate-related factors. Thailand's climate is monsoonal in nature. Normally 80 per cent of annual rainfall occurs between May and October as a result of the summer southwest monsoon. The basin also has relatively flat topography. As a result, during particularly wet months (typically August and September) rivers in the basin carry high levels of runoff that can overflow and drain slowly, which leads to flooding (Gale & Saunders, 2012; Komori et al., 2012). The impact of flood in the Basin is often further exacerbated by the impact of tropical storms drifting over Thailand from the northwest Pacific. Further, industrial and urban development in the delta region has also worked to reduce natural flood retention areas and weaken flood defences (Gale & Saunders, 2012; Pavelic et al., 2012).

Table 3-1 Largest flood events in Thailand for period 1985-2012 ranked by flood magnitude

Year	Flood magnitude	Duration (days)	Area affected (km^2)
1995	7.9	101	444,000
2002	7.9	101	372,000
2006	7.7	116	213,000
2004	7.6	59	378,000
2011	7.5	158	97,000
2007	7.3	67	300,000
1994	7.1	107	65,000
2005	7.1	45	134,000
2003	7.0	31	315,000
1996	7.0	35	314,000

Flood magnitude = log (Duration * Severity * Area Affected)

'Severity' depends on estimated recurrence interval of floods in the region affected and is defined on a scale between 1 and 2

Source: Gale & Saunders (2012)

The flooding that inundated a substantial portion of Thailand, and the Chao Phraya Delta in particular, during the second half of 2011 exacted a considerable toll on the Thai people and the Thai economy. While not the largest recent flooding event in Thailand in terms of flood magnitude or area affected (Table 3-1), it was the longest flood event on record in terms of flood duration and has been described as the worst flood event in modern Thai history (Gale & Saunders, 2012; Poaponsakorn & Meethom, 2013). The floods affected 12.8 million people and were responsible for 728 deaths and approximately US$46.5 billion in loss and damage. Around 56 per cent of this amount was attributed to losses with the remainder constituting damage to existing assets and infrastructure.

The primary reason behind the floods has been cited as above average rainfall for the whole of 2011, including record high levels of rainfall during the monsoon period from July to September. At a national level, average precipitation in 2011 was 23 per cent above normal. The remnants of five consecutive tropical storms between July and October 2011 also added heavy rain in the northern and central regions of the Chao Phraya Basin, which led to flash floods and raised water levels in major mid-Basin dams to their maximum capacity. These storms were estimated to have contributed as much as one third of the total rainfall observed in the north of Thailand over the July to October period (Gale & Saunders, 2012).

The probability of such high levels of rainfall occurring again in the near future is a matter of contention. Poaponsakorn & Meethom (2013) cite an assessment by the World Bank following the floods, which estimated that the probability of such a rain event was one in 250 years. However, a detailed assessment of historical meteorological data and rainfall return periods by Gale & Saunders (2012) estimates that the return period of a rainfall event such as that observed in Thailand in 2011 as somewhere between eight to 20 years. Importantly, these assessments are based on historical data and do not attempt to factor potential future changes in precipitation levels that may result from climate change. For example, in its Second National Communication to the UNFCCC in March 2011 the Thai Government noted that instances of drought and flood had become increasingly frequent and severe (MoNRE, 2011). Locally produced climate modelling seemed to indicate that these trends would continue. Using a dynamically downscaled regional general climate model, Chinvanno (2009) estimated that some areas of Thailand could expect average precipitation levels to increase by 25 to 50 per cent over the coming century.

The intensity of the flooding was exacerbated by water runoff well in excess of the carrying capacity of the rivers in the Basin, urbanization and unsuitable land use practices in the delta region, insufficient drainage and flood protection and poor management of existing flood control infrastructure (Impact Forcasting LLC, 2012; Komori et al., 2012; Poaponsakorn & Meethom, 2013). The flood waters in 2011 rose at a slower pace when compared to previous flood events and persisted for a long time before receding. In many cases this resulted in river dykes overtopping and breaching in many river arms. Ageing and poorly maintained flood protection and irrigation infrastructure was also blamed for major flooding in some areas (Poaponsakorn & Meethom, 2013).

The reasons cited for the severity of the human and economic impact observed during the 2011 floods were closely associated with poor water management in the Chao Phraya Basin. Significant blame was directed towards the managers of major dam infrastructure on the Chao Phraya Basin (Gale & Saunders, 2012). In the period before September when it was already apparent that Thailand was facing a higher than average rainfall year, the water outflow from the two major dams on the Chao Phraya River, the Bhumibol and Sirikit dams, was kept at levels below the level of inflow until after it was clear that water would need to be released to prevent the dams themselves from overflowing. Also documented were incidents where major sluice gates at strategic points along the river were not fully opened until it was too late to avoid further and prolonged flooding (Bangkok Post, 2011a; Poaponsakorn & Meethom, 2013).

Another related factor behind the significant impacts of the floods was poor urban planning and unchecked development (Fogarty & Baldwin, 2012; McQuay, 2011b). In the regions north of Bangkok non-existent land zoning practices resulted in the construction of major industrial estates and housing developments on areas that were traditionally flood plains (Schmidt-Thome, 2012). Unsurprisingly, many of these estates were inundated as the flood waters approached Bangkok resulting in considerable economic losses (McQuay, 2011b). The impact of these poor planning decisions were suddenly felt worldwide as key components of global manufacturing supply chains based in these regions of Thailand succumbed to the floods (Fuller, 2012; Withitwinyuchon, 2011).

The 2011 floods were unique because of the risk they posed to economic activity in the Chao Phraya delta region and the Thai capital (IRIN, 2011; Phoonphongphiphat & Petty, 2011; Ploy, 2011). In Bangkok rapid economic development and effective lobbying had encouraged the conversion of areas in eastern Bangkok, which were once designated as flood ways, into residential developments (Poaponsakorn & Meethom, 2013). Residents in certain parts of the city were forced to bear the brunt of the flood waters as measures were adopted to keep the city centre safe from inundation (Bangkok Post, 2011a, 2011c). As the floods continued to flow towards and eventually surround central Bangkok, the threat they posed to the country's economic and political centre became a source of anxiety and miscommunication on the part of the national government and the Bangkok metropolitan government (Mahitthirook, 2011; McQuay, 2011a).

3.2. The Thai Government's response to the 2011 Floods

3.1.4. Adaptation and water policy in Thailand at the time of the floods

At the time the 2011 floods occurred, Thailand's climate change adaptation policies were still in relatively early stages of development. Thailand had submitted two national communications to the United Nations Framework Convention on Climate Change (UNFCCC); one in 2000 and another in early 2011 (MoNRE, 2011; MoSTE, 2000). In these communications Thailand had identified uncertainty regarding climate change impacts, low capacity with techniques to prioritize adaptation actions and difficulty integrating adaptation into broader socio-economic development as key challenges (Gass et al., 2011). In relation to adaptation and water resources, the 2011 communication highlighted coping with variable seasonal water supply and rising water demand as the most important challenge for the water sector. As a result, and consistent with moves to decentralize water resources management, the policy priorities identified by the government included integrated and community-based water resources management, water pricing, water conservation and crop diversification (Gass et al., 2011; MoNRE, 2011). This forward-looking approach was complemented by Thailand's National Strategy for Climate Change (2008-2012), which prioritized research and development on climate change adaptation, capacity building and awareness raising as some of the key focus areas for action (Gass et al., 2011). Despite the methodical and inclusive aspirations of the Thai Government's adaptation policy framework, its response to the 2011 floods resulted in a reactive set of policy measures that were not entirely consistent with these aspirations.

3.1.5. The Thai Government's response to the floods

The Thai Government response to the 2011 floods is interesting and worthy of investigation for a number of other reasons. The 2011 floods, while devastating, were likely perceived by the Thai Government as a unique window of opportunity to develop and implement substantive policy measures to strengthen the capacity of the Thai population to adapt and respond to future, similar climate threats. The response involved a number of changes to prevailing water governance institutions and policy adjustments involving a range of financial, technical and hard infrastructure measures. The Thai Government's response also explicitly factored in both short-term measures to address the immediate crisis resulting from the flood and long-term measures to address future incidence of similar flood events. Many of these measures were being designed and adopted as the floods were occurring.

Design of the response was complicated by a range of concomitant political pressures. The flood crisis developed as a new Thai Government was being installed in August 2011 after a bitterly contested election. The new Thai Prime Minister, Yingluck Shinawatra, was the sister of Thaksin Shinawatra, a former Prime Minister and deeply polarizing political figure in Thailand (Farrelly, 2012). At the time of her election the new Prime Minister and her new government were heavily scrutinized to uncover the nature of its links to her brother who was living in self-imposed exile following charges of corruption (Bangkok Post, 2011e). The floods presented an immediate challenge for the new government and a very public barometer of its capacity to fulfil its new role (ADB, 2012; Roberts, 2011). Drawing on media reports at the time, public satisfaction with the competency of the government's immediate response to the floods was low, which may have added impetus to develop a longer term plan to mitigate future crises (Mahitthirook, 2011; McQuay, 2011a; Nindang & Allen, 2012; Saengpassa, 2011; Stratfor, 2011; Techawongtham, 2013). Business groups and investors, many with operations inundated or at risk of flooding, were also placing pressure on the government to act (Chudasri et al., 2011).

A key element of the Government's response was the creation of new water governance bodies to replace existing governance structures or fill perceived gaps within the existing governance system (Sullivan, 2012). In November 2011, the Thai Government established the Strategic Committees for Reconstruction and Development (SCRF) and Water Resources Management (SCWRM) to devise the immediate Thai Government response to the floods and establish long-term plans to address instances of possible future flood events (ICEM, 2014a; Kumpa, 2012). These committees were comprised of current and former government ministers and supported by teams of bureaucrats and technical experts (ICEM, 2014a; Withitwinyuchon, 2011).

At the recommendation of the SCRF and SCWRM new national level command structures known as the 'Single Command Authority' were added to the water governance framework in Thailand. These new structures included the National Water and Flood Policy Committee (NWFPC), which was chaired by the Prime Minister, and the Water and Flood Management Commission (WFMC), which was chaired by the Minister for Science and Technology (Figure 3-2) (Termpittayapaisith, 2012). An Office of the National Water and Flood Policy Commission (ONWFPC) was established to support the NWFPC and WFMC. These bodies

were tasked with formulating and implementing policies and guidance on water management issues and making recommendations to the Thai Cabinet on budgets and loan approvals for water management projects in Thailand. In effect, these bodies became the highest water policy-making bodies in Thailand replacing the prevailing National Water Resources Committee, which was established in 2007 by the interim government that followed a coup in 2006 (ICEM, 2014a).

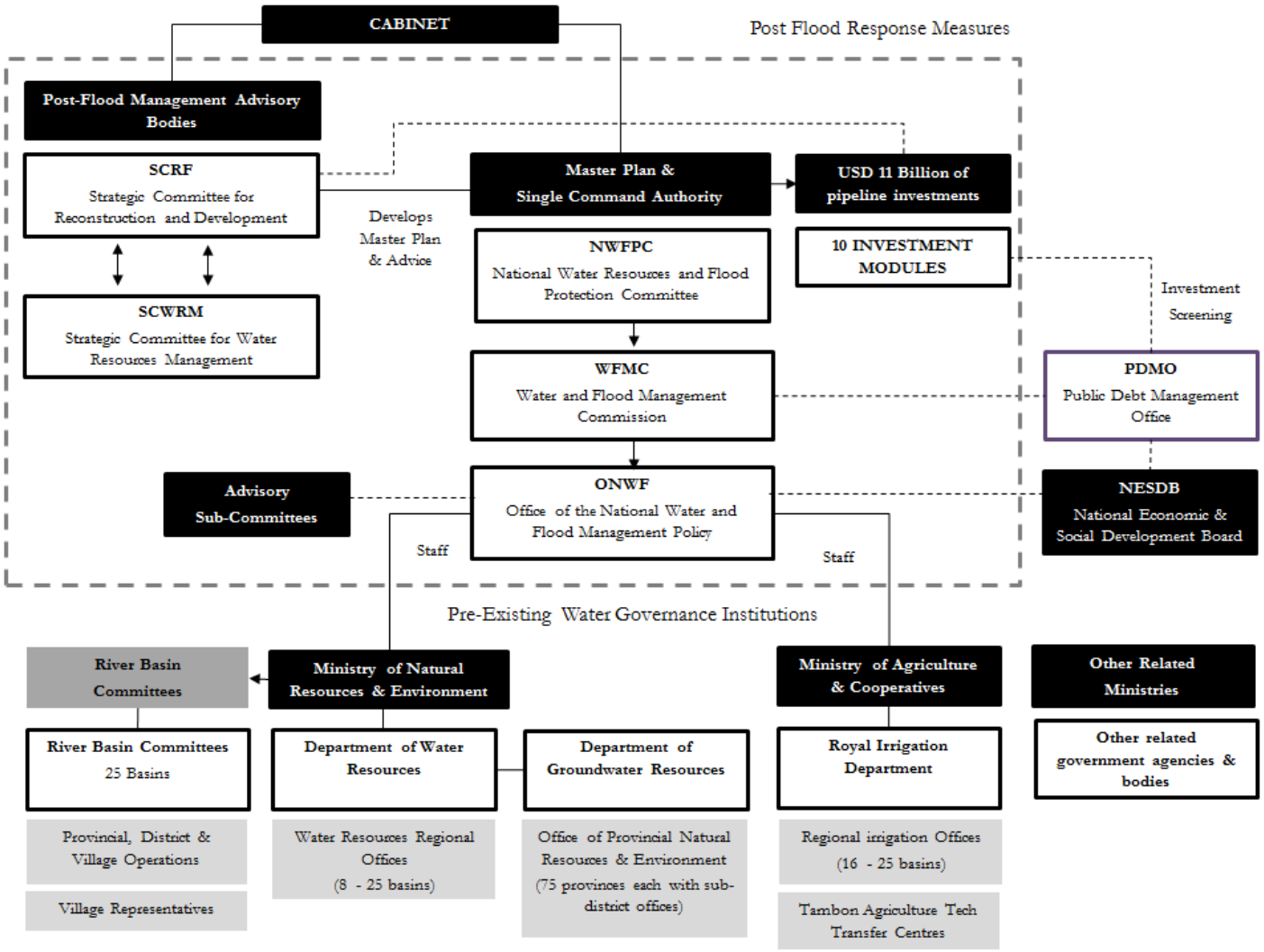

Figure 3-2 Overview of the Thai water governance framework and policy response to the 2011 floods

Source: ICEM, 2014; Kumpa, 2012; Termpittayapaisith, 2012

3.1.6. Thai Government Master Plan for Water Resource Management

Perhaps the most significant proposal developed by the SCRF and SCWRM that was later adopted by the 'Single Command Authority' was a new Master Plan for Water Resources Management (Poaponsakorn & Meethom, 2013). The Plan was developed in November 2011 and approved by the Thai Cabinet soon after in December 2011 (Hariraksapitak et al., 2011). The objectives of the Plan were to reduce loss and damage from flood events, improve flood prevention capacity and build confidence in Thailand's water management capacity (NESDB, 2012). The Plan was comprised of eight key work plans that were further

sub-divided into two action plans; one to address issues arising from the immediate flooding crisis and another to promote integrated and sustainable flood mitigation in the Chao Phraya River Basin. These action plans were further sub-divided into 14 detailed activity plans (Figure 3-3). This thesis focuses on the long-term policies and measures of the Plan that comprised the Action Plan on Integrated and Sustainable Flood Management in the Chao Phraya River Basin. These measures are described in Table 3-2.

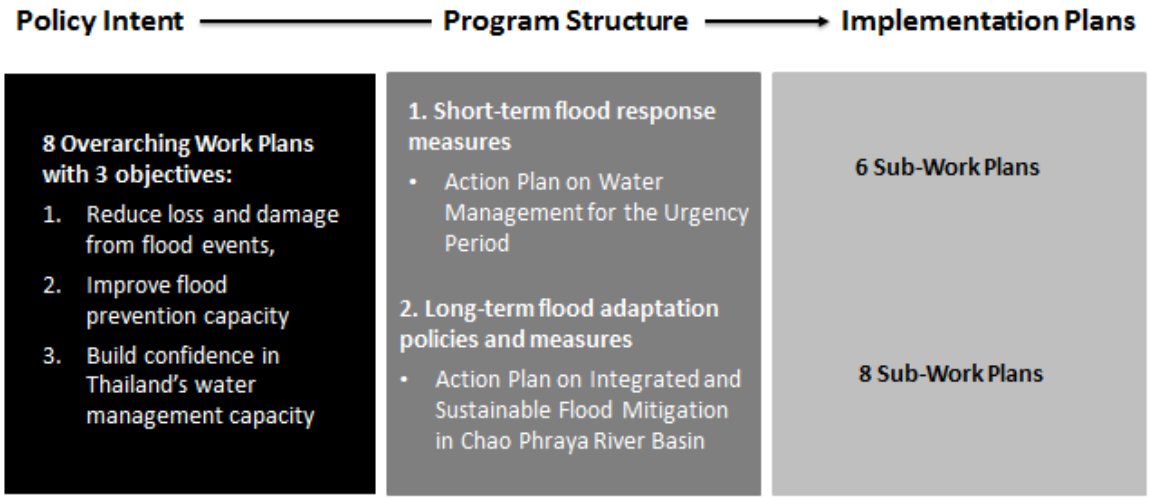

Figure 3-3 Overview of the Thai Government Master Plan for water resources management

Adapted from Kumpa, 2012

To give effect to the adaptation elements of the Plan it was supported by an emergency decree in January 2012 to authorize the government to borrow over US$11 billion to invest in the flood and water management measures called for in the Plan (ICEM, 2014a; Kumpa, 2012; TPRD, 2012b). The terms of the decree stipulated that the government had to allocate the funds within one and a half years, otherwise they would lapse and alternative financing arrangements would need to be identified (Limsamarnphun, 2013; The Nation, 2013b). The funds to be borrowed with the emergency decree were divided into 10 investment modules (see Table 4-2). The modules followed a 'design-and-build' procurement model, which was similar to the model adopted by the United States and Netherlands Governments in response to previous flood related disasters (ICEM, 2014). As a result, the details of the Plan and the investment modules when they were adopted by the Thai Government were minimal. It was envisioned that further details and due diligence requirements would be fleshed out after the investment modules were allocated to independent contractors following a public bidding process. These modules are discussed in more detail in Section 4.

Table 3-2 Long-Term Adaptation Policies and Measures Incorporated into the Master Plan

	Sub-Work Plans	Budget (Billion US$)	Adaptation Type
1	**Work Plan for Restoration and Conservation of Forest Ecosystems** • Projects including soil improvement and conservation and rehabilitation of forest areas	1.9	Adaptation Action
2	**Work Plan for Management of Major Water Reservoirs and Formulation of Water Management** • Formulation of water management plans at major dams under various scenarios	-	Building Adaptive Capacity
3	**Work Plan for Restoration and Efficiency Improvement of Current and Planned Physical Infrastructure** • Construction of flood ways, dams and dikes • Improvement of land use zoning	5.7	Adaptation Action Building Adaptive Capacity
4	**Work Plan for Information Warehouse and Forecasting and Disaster Warning System** • Establishing forecasting and warning system	0.1	Adaptation Action
5	**Work Plan for Response to Specific Areas** • Develop system for flood prevention and mitigation in important areas • Negotiation with flood affected communities	-	Building Adaptive Capacity
6	**Work Plan for Selecting Water Retention Areas and Recovery Measures** • Designing and constructing water retention areas • Irrigation systems	1.9	Adaptation Action
7	**Work Plan for Improving Water Management Institutions** • Setting up integrated water management organizations	-	Adaptation Action
8	**Work Plan for Creating Understanding, Acceptance and Participation in Large Scale Flood Management from all Stakeholders** • Public awareness activities to encourage public participation in public water management activities	-	Building Adaptive Capacity

Source: NESDB (2012)

3.1.7. The Master Plan as an example of an adaptation policy program

For the purpose of the subsequent analysis, it is argued that this component of the Master Plan was an example of an adaptation policy program. As noted above, a policy program is the manifestation of a policy, which in turn is defined as a position taken or communicated by a government (Dovers & Hezri, 2010). Policy programs comprise elements of implementation as well as intent to take action to realize adaptation related goals. In the case

of the Thai Government's policy response to the 2011 floods, the rationale for the Master Plan states that in addition to addressing the immediate impact of the 2011 floods it should address the possible impact of future floods (NESDB, 2012). There is an implicit assumption in the Thai Government's justification for the Plan that climate change was a key factor behind the severity of the 2011 floods (Juntopas, 2013).

Consistent with the definition of adaptation outlined above, the long-term component of the Plan involved both the building of adaptive capacity and implementing adaptation decisions or actions; in this case to design and construct infrastructure to reduce vulnerability and enhance resilience to future flood events. Policy programs such as the Master Plan, which aim to develop structural and non-structural measures for flood control and mitigation are widely analysed in the literature as a form of climate change adaptation (Daniell et al., 2010; Fazey et al., 2010; Mechler et al., 2010; Mimura et al., 2014). In an Asian context, the particular susceptibility of cities in the region to flood and sea level rise has resulted in climate change adaptation often being equated with questions of how to address flooding (Scott, 2012). As a result, for the purpose of this thesis it is argued that this example may provide useful insights into the phenomena of 'policy windows' for climate change adaptation that are assumed to open in response to extreme climate events.

In this Section an overview of the historical and policy context to the 2011 floods and the Thai Government policy response was provided. A range of biological/physical characteristics of the Chao Phraya River Basin have meant that flood is a regular occurrence in the delta region. Economic development and population growth has resulted in accelerating development in the basin and efforts by the Thai Government to control flooding and allocate water resources for agricultural activities. Water management in Thailand is complicated by the lack of an overarching water law and the proliferation of water governance bodies – sometimes with competing management priorities. The 2011 floods were driven by above average rainfall and exacerbated by poor management and planning policies. In response to the floods the Thai Government implemented a range of changes and policies including a program of long-term adaptation measures designed to reduce vulnerability and enhance resilience to future flood events. In the next section the explanatory framework will be applied to assess the way that transaction and other costs were estimated and managed in the development and implementation of this Plan.

4. Application of the framework to the Thai Master Plan

In this Section the explanatory framework is applied to the Thai government response to the 2011 floods. The purpose is to establish whether the adaptation policy program adopted by the Thai Government in response to the 2011 floods resulted or potentially resulted in poor adaptation outcomes from a cost and efficiency perspective and why. Application of the framework proceeded as follows. Firstly, the 2011 floods and Thai Government response was assessed to establish to what extent they aligned with the general characteristics of a policy window. Secondly, consideration was given to evidence of the way that the Thai Government estimated and managed transaction costs in developing and implementing the Plan. The Section concludes with a summary of the analysis and conclusions regarding whether the Thai Government response to the 2011 floods, in particular the Master Plan for Water Resources Management, resulted or potentially resulted in poor adaptation outcomes from a cost and efficiency perspective. As noted previously, measurement of the costs associated with such policy programs is complicated and difficult. It was outside the scope of this thesis to quantify each of the cost items that comprise the cost trade-off. However, the documentary record that was available on the design and implementation of Plan was able to provide sufficient material for a qualitative analysis that provides insight into the way costs were estimated and how they were managed during the development and early implementation of the Master Plan.

4.1. 2011 Floods and Thai Government Response as Policy Window

4.1.1. Institutional and physical/biological context of the 2011 floods

The context for adaptation policy in Thailand at the time of the 2011 floods was difficult. Given the institutional and physical/biological context for water management that prevailed just prior to the 2011 floods, it seems unlikely that the Master Plan would have otherwise been enacted. The institutional environment for water management in Thailand was particularly complex. As noted in Section 3, water management activities were shared by a wide range of agencies which often competed for influence (ADB, 2012). Despite moves to decentralize water governance to provincial agencies outside of Bangkok, central government agencies still controlled the national water management budget and policy planning process (ICEM, 2014a). In addition, the adaptation policy architecture that prevailed at the time of the floods was advocating a measured and consultative approach to adaptation policy that aimed to reduce uncertainties associated with action and ensure that action was properly vetted by a range of stakeholders (Gass et al., 2011; MoNRE, 2011).

Perhaps the most problematic institutional factor for design and implementation of the Master Plan was the low levels of social capital and trust in Thailand when the flood crisis struck. Since the Prime Minister's brother had been ejected from office in 2006, Thailand had been subject to regular waves of protest and political violence (Farrelly, 2012, 2013). In 2010, the government prevailing at that time had violently supressed protestors, largely from the Northern provinces, in Bangkok. While the new government was given a chance to restore faith in Thailand's governing institutions, the impact of these conflicts was still lingering when the floods struck.

The physical/biological context to the 2011 floods also presented challenges for action. The scale of the flooding problem was large. For action to be effective in the Chao Phraya alone it needed to account for water resources and management practices across eight sub-basins and more than 20 provinces. Action at this scale would obviously involve a wide range of human and natural agents increasing the likelihood that action would lead to potentially negative external effects for some groups (see Francois Molle, 2007; Sneddon, 2002).

The problem at hand, namely climate change and extreme climate events, also involved high levels of uncertainty. It was unclear whether a wide-ranging policy program would be successful in mitigating future similar incidences of flood and to what extent action to address these problems could be accurately measured or observed (MoNRE, 2011; MoSTE, 2000). Flood was also not the only or even most pressing climate related problem facing Thailand. Drought was becoming a significant problem in upstream parts of the Chao Phraya River basin. In 2010, one year before the flood, Thailand suffered its worst recorded case of drought (Nehru, 2011; Watts, 2012). The confluence of these factors would have normally made the negotiation and implementation of a costly and wide-ranging policy program such as the Master Plan relatively difficult. However, the 2011 floods opened a policy window that may have obscured some of the complexity involved with the design and implementation of adaptation action such as the Master Plan.

4.1.2. Convergence of Problem, Political and Policy Streams

The 2011 floods resulted in a convergence of policy, problem and political policymaking streams into a policy window for the Thai Government to develop and implement an adaptation policy program. While flooding was a common problem in the Chao Phraya Basin, the 2011 floods presented an extreme case due to their extent, duration and impact. The extreme nature of the floods and the threat they posed to key interest groups in the delta region and the capital Bangkok created a strong impetus for action on the part of the government (TPRD, 2011g). This impetus was enhanced by the scrutiny that was being applied to the new government by the opposition party and the escalating tally of human and economic losses wrought by the floods (Fogarty & Lim, 2011; Reuters, 2011; Wiriyapong & Vanichkorn, 2011). The government's will to act was eventually embodied in the governance changes that led to the replacement of existing water policy bodies with the 'Single Command Authority'.

While an adaptation policy response was not essential to restore the basin to a state equivalent to that which prevailed before the floods, in identifying policy solutions the government regularly made reference to longer-term measures that implied adaptation and the need increase resilience and reduce the likelihood that such a crisis wold occur again. During the flood event the World Bank indicated that the government's response to the floods was an opportunity to 'build back better' improving the country's capacity to withstand volatile climate changes in the future (Vanichkorn & Banchongduang, 2011). The Prime Minister noted that climate change and global warming were key considerations in development of the government's response (TPRD, 2012a). this support for adaptation action was consistent with broader discourse in the political sphere and media regarding climate change (Nehru, 2011; Win, 2011). The need to adopt long term action was also

motivated by the government's desire to restore investor confidence in the future prospects of the country following the considerable physical damage and economic losses suffered to private manufacturing enterprises on the outskirts of Bangkok (Montlake, 2011a; TPRD, 2011g).

4.1.3. Coupling the floods with the adaptation measures in the Master Plan

In designing its adaptation response to the floods, the government appeared to couple a backlog of measures with the flooding problem at hand. Many of the measures that were rolled into the plan had been floating in the policy sphere for some time. As early as October 2011, the Thai Government was indicating that longer-term adaptation measures, such as early warning systems, diversion channels and new water retention areas, would be a necessary elements of the response to the flood crisis (TPRD, 2011b, 2011e). By the time the Master Plan was taking shape in November and December 2011, it reportedly included a range of different long-term measures consistent with the features of an adaptation policy program (TPRD, 2011c, 2011h). Many of these measures were devised or promoted by the SCWRM, which was largely comprised of policy entrepreneurs with long standing links to the government's water management agencies (TPRD, 2011f; Withitwinyuchon, 2011). As noted above, many of the measures included in the Plan had been the subject of planning or consultation processes in the past and were likely known to the seasoned water management professionals who were charged with development of the Plan. Other measures were also borrowed from pre-existing plans developed by the Japanese International Cooperation Agency and the Thai Crown Property Bureau (TPRD, 2012b). As a result of the convergence of the factors described above, a policy window for adaptation action was formed.

4.2. The cost trade-off involved in the decision to adopt the Master Plan

4.2.1. Efficiency and cost as decision-making criteria for the Thai Government

Before assessing whether the Master Plan was successful from a cost and efficiency perspective, it is first worthwhile to consider whether cost and efficiency were criteria of interest to the Thai Government in the development and implementation of the Master Plan. There is some evidence to indicate that efficiency and cost were important factors in the decision-making process. For example, in announcing the Plan the Prime Minister stated that one of the government's considerations in developing the Plan was to increase the efficiency of flood prevention in Thailand (TPRD, 2012a) implying that adopting the most efficient response was a concern for Thai policymakers. The government's interest in the efficiency of action over inaction was also sometimes implied in government press releases and news reports. For example, in announcing the US$11 billion emergency decree to fund the implementation of the Master Plan, the government highlighted that the expected cost of the damage caused by the 2011 floods were expected to exceed US$40 billion (Hariraksapitak et al., 2011; TPRD, 2012b). The implication here being that, based on a crude, static comparison, the cost of action to prevent the future incidence of such floods was an efficient alternative. Further evidence will now be presented to establish whether adaptation drivers

were present at the time of the floods that may have influenced Thai policymakers assessment of the cost trade-off involved in adopting the Master Plan or maintaining the status quo.

4.2.2. Specific adaptation drivers of the policy window arising from the 2011 floods

As described in Section 2, policymakers will be influenced by certain adaptation drivers when assessing the relative merits of adopting an adaptation policy program in response to such an extreme climate event. In the Thai case, it was expected that there would be evidence available to indicate whether such drivers influenced the way that the Thai Government evaluated and managed costs associated with the design and adoption of the Master Plan. This evidence is presented below and summarized in Table 4-1.

A number of adaptation drivers emerged from the 2011 floods. The 2011 floods created new awareness in extreme climate events in Thailand; particularly in Bangkok, which is often spared from more regular flooding events in the upper and middle regions of the Chao Phraya basin (Komori et al., 2012). As the flood waters approached Bangkok and details of potential mismanagement of dams in the northern reaches of the basin began to be reported in the news media, public opinion of the crisis began to focus on the failure of existing flood management practices (Bangkok Post, 2011d; Roberts, 2011; Saengpassa, 2011; Stratfor, 2011). Damage and losses inflicted on private businesses around Bangkok and the destruction of range of existing flood mitigation infrastructure created a general need for reconstruction and repair (TPRD, 2011d, 2012a). The floods also exposed the Thai Government's management of the flood situation and any subsequent response to significant scrutiny from external stakeholders (Busbarat, 2012; Fuller, 2012; Osborne, 2012). Numerous global manufacturing networks, rations were suspended due to the inundation and damage experienced at key Thai-based facilities.

The 2011 floods and the loss and damage they caused created a strong impression that Thailand's water management system was not working and needed to be quickly improved (Ploy, 2012; Roberts, 2011). Perceptions grew that the government had mismanaged the flood situation and that the prevailing current water management system involved significant institutional weaknesses, particularly in the way that water management was effectively spread across a wide range of different public bodies (Anukularmphai et al., 2012). This prompted the government to quickly establish the 'Single Command Authority' governance arrangement described in Section 3, which effectively centralized water management authority, but also opened up the possibility that vested interests in the water sector would be weakened.

Table 4-1 Specific adaptation drivers of the Policy Window that opened in response to the 2011 Thai Floods

Adaptation driver	Applied to the 2011 Floods Case Study
New awareness of risk after an extreme event leads to consensus	• Significant national and international media coverage • Regular commentary from government indicating need for action to tackle future instances of flood
Problems with prevailing policies are revealed	• Regular criticism of existing management policies • Competition and fighting between water management bodies
Institutional weaknesses are exposed	• Flood crisis regularly used as an example of poor governance and policy arrangements for flood management
Old vested interests are weakened	• New agencies were created and old bodies replaced
External stakeholders are 'reminded' or 'reacquainted' with risks	• Regular pressure from external groups including investors and development organizations
Existing infrastructure lost or damaged	• Reports of infrastructure failing to cope with flood waters or being destroyed by the floods
Enhanced political will	• Regular announcement by the Thai government over a three month period that long-term measures were required to address future instance of flood
Money becomes available to do things better	• Thai Government decides quickly and decisively to allocate substantial funding to new measures • Thai Government creates unique funding mechanism with the emergency decree to ensure that measures are funded

The combination of these drivers of the policy window opened by the floods galvanized political will for the development and implementation of a long-term plan and policy program that would restore confidence in Thailand and strengthen capacity to adapt to and mitigate similar future flood events (Hariraksapitak et al., 2011; TPRD, 2011e, 2011g, 2012c). Once the political will for action was established the government set about ensuring that financial resources would be available in form of the emergency funding decree. According to the theory outlined in Section 2, the presence of these drivers would also produce evidence that policymakers may have overlooked or underestimated the transaction and other costs involved with developing and implementing the Master Plan.

4.2.3. Costs of inaction associated with the status quo water and flood management system in Thailand

There is reason to believe that following the 2011 floods Thai policymakers may have considered that the costs of inaction associated with the status quo water and flood management system to be particularly great. These costs were reflected in the estimates of human and economic loss and damage that resulted from the inability of Thailand's prevailing water management system to withstand and mitigate the impact of the floods.

Monetary estimates of loss and damage were regularly cited in Thai Government and third party evaluations of the floods (Chudasri et al., 2011; Fogarty & Lim, 2011; Wong, 2011). As a result, these estimates represented an important proxy value for implementation failure costs. The most widely cited estimate was the US$46.5 billion figure produced by the World Bank in November 2011, which was later verified by the Thai Government (Chantanusornsiri, 2011; Chomsri & Sherer, 2013; Impact Forcasting LLC, 2012; NESDB et al., 2013; NESDB, 2012; Vanichkorn & Banchongduang, 2011).

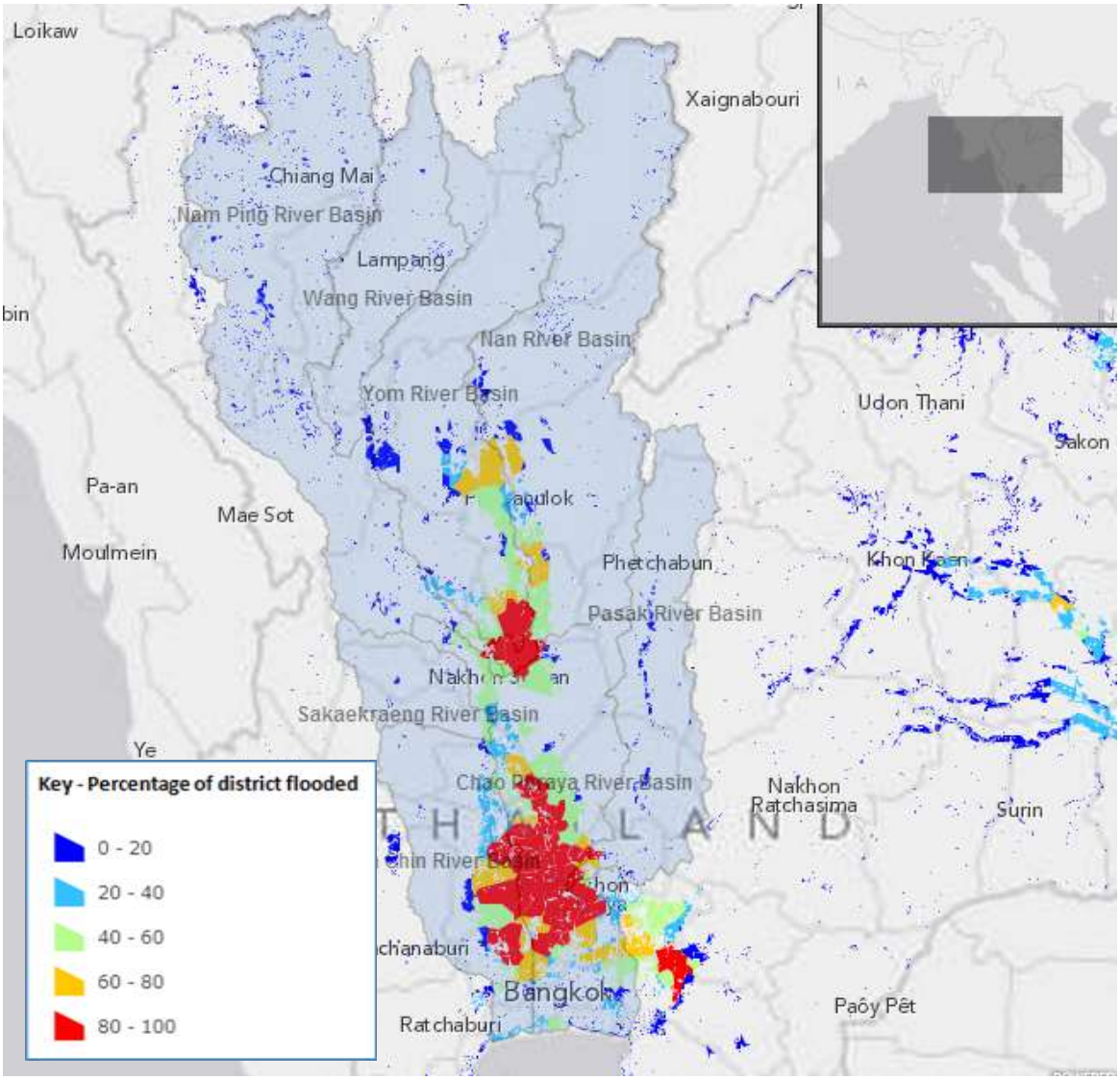

Figure 4-1 Extent and spread of the 2011 Thai floods

Source: ArcGIS (http://www.arcgis.com/home/webmap/viewer.html?useExisting=1)

The Thai Government confirmed that the vast majority (more than 95%) of these costs were borne in the delta region of the Chao Phraya River Basin where the worst of the flooding was concentrated (Siripornpibul, 2012) (Figure 4-1). Private property and assets accounted for around 90 per cent of those affected (Poaponsakorn & Meethom, 2013). The

manufacturing sector suffered a disproportionate amount of loss and damage due to the high concentration of electrical, automotive, medical equipment and food and beverage manufacturers in the delta region north of Bangkok (Impact Forcasting LLC, 2012). Private residences were also hard hit. It is estimated that as many as 700,000 homes and 7,510 industrial and manufacturing plants suffered inundation damage (Impact Forcasting LLC, 2012). As a result, the floods depressed consumer and business confidence and reduced growth forecasts for the whole Thai economy (Montlake, 2011b). This was exacerbated by around US$400 million of damage that was caused to existing water management infrastructure such as sluice gates and dykes (Siripornpibul, 2012).

The estimates of implementation failure costs would have been influenced by expectation of whether a flooding event similar to the 2011 floods could happen again. Despite flood return estimates of between 20 and 250 years, the recent experience with of the floods drove speculation that floods of a similar magnitude may become a new norm (Finch, 2012; J. Head, 2012). Even as the Thai Cabinet was meeting to discuss the Plan and emergency funding decree, residents and farmers were warned to prepare similar potential for flooding in 2012 (Keeratipipatpong, 2012).

It is considered unlikely that the Thai Government explicitly evaluated the costs associated with the benefits foregone from not adopting an adaptation response to the 2011 floods. However, due to the mix of adaptation drivers described above, it is likely that policymakers may have perceived that the opportunity costs associated with not taking action in response to the floods were relatively high. The government saw post flood reconstruction as a key measure to rebound from the floods and restore investor confidence in the country (Montlake, 2011b). This view was shared by financial commentators and analysts at the World Bank and ADB (Chantanusornsiri, 2011; Chudasri et al., 2011; Roughneen, 2012; Vanichkorn & Banchongduang, 2011). The Master Plan and its strong focus on the construction of hard infrastructure measures fit well with this overall philosophy.

4.2.4. Costs of action associated with Thai Government's Master Plan

When compared to the loss and damage caused by the floods, the costs of action embodied in the Master Plan may have seemed to policymakers like a good deal for Thailand despite being one of the most costly water management initiatives in the country's recent history (Kumpa, 2014). These costs of action were most clearly embodied in the government's US$11 billion price tag for the ten investment modules that would give effect to the sub-work plans on long-term flood adaptation. The ten investment modules were divided into two packages (A & B) with the majority focused on the Chao Phraya River Basin (Package A) (Table 4-2). The costs of these modules, which became synonymous with the broader Plan, represented an important proxy value for the production costs of action associated with the Plan.

Funding allocated for the modules was focused largely on traditional hard infrastructure or structural measures such as dam, reservoir and flood way construction. However, the Plan also included allocations for non-structural measures such as dredging and the establishment of additional water retention areas (named 'Monkey Cheeks') and provisions for improved

planning practices, flood forecasting services and water management systems (Poaponsakorn & Meethom, 2013). As noted in Section 3, some of the modules involved controversial measures that had already been subject to lengthy public debate and even opposition such as the Kaeng Sua Ten dam in the Yom River Basin and the Mae Wong dam in the Sakae Krang River Basin (Blake, 2014; Sattaburuth, 2013; The Nation, 2012).

While the expected cost of the modules were a regular feature of government announcements and media reports regarding the Plan, it was considered unclear how these cost estimates were developed (Techawongtham, 2013). As a result of the 'design and build' methodology adopted by the government, the specific details of the investment modules were not defined until sometime after the Plan was adopted. It was only in early 2013 when private contractors submitted bids to implement the modules and more specific plans that the production costs could have been assessed with any certainty. However, perhaps unsurprisingly, the bids submitted by the private contractors involved costs strikingly similar to the figure estimated when the Plan was first adopted and very few details of the modules were known.

Thus, in designing the Plan, perhaps because it was anticipated that the government would not be responsible for the detailed design and negotiation of the Plan measures, the government invested relatively little in typical decision-making costs such as research, program design and consultation with stakeholders. The Plan was developed quickly over the space of two months. Due to the urgency associated with development of the Plan it was designed largely by the new SCWRM and a small network of advisers (ETNA, 2012; Withitwinyuchon, 2011). Very few details of the Plan were made public before it was adopted by Cabinet (Bangkok Post, 2011b). Once it was made available, the Plan itself was a relatively incomplete blueprint comprising only 17 pages (NESDB, 2012). As the Plan was thin on details it necessarily deferred much of the cost associated with decision-making to a later date and the private contractors who would be asked to implement the modules.

Evaluation of the decision-making and production costs associated with the modules is complicated by the fact that the Thai Government embedded a number of important decision-making costs into the module's price tags. Private contractors were expected to shoulder a range of other costs in their bids, such as negotiation for land acquisition and community consultation (Bangkok Post, 2013a). However, it is unclear from the more detailed investment module proposals that emerged in 2013 what portion, if any, of the bids were allocated to these types of decision-making transaction costs (WFMC, 2013b, 2013c, 2013d, 2013h). The Thai Government and private contractors could have attempted to estimate these costs using proxy values from other consultation processes adopted for similar water management activities.

For example, the government allocates provincial-level agencies an annual budget of approximately US$64,000 for consultation with communities on general water management issues. This amount is widely considered to be insufficient to deliver effective water management outcomes (ICEM, 2014b). If it were assumed that, at a minimum, the measures included in the modules would have required additional consultations in each province of the Chao Phraya River Basin of a similar nature to those envisioned for general water

management issues. This would have represented an additional bare minimum cost of approximately $US1.5 million to be absorbed somewhere in the Plan modules. Shortly after the Thai Government adopted the Plan it requested assistance from ADB to develop guidelines for implementation of the Plan and establish a basin-level consultation for one of the Chao Phraya river sub-basins. Thi project alone was worth US$1.5 million indicating that consultation costs could have been considerably more than this (ADB, 2014).

Table 4-2 Overview of the Master Plan investment modules

Module	Title	Key Measures and Features	Cost ($US)
Modules A1 & B1	Construction of suitable and sustainable reservoirs	• Study, survey, design and construct reservoirs in Ping, Yom, Nan, Sakae Krang and Pasak river basins • Construction to be completed within 5 years	2 billion
Modules A2 & B2	Land Use Mapping / Land Utilization Plan and Construction of Flood Protection Measures for Communities and Major Economic Areas	• Prepare land use plans and establish and use zones • Plans to be in place within 3 years • Construct flood protection measures such as diversion channels, embankments and secondary roads • Construction to be completed within 5 years	1.94 billion
Module A3	Temporary Flood Retention Areas (Monkey Cheeks)	• Study, design and construct monkey cheek retention areas for improved flood retention • Construction to be completed within 5 years	1.94 billion
Module A4	Improvement of Main Waterways and Prevention of Erosion along the river banks of the Yom, Nan and Chao Phraya river basins	• Design improvements for Yom, Nan and Chao Phraya rivers including canal enlargements, new canal construction and removal of waterway obstructions • Construction to be completed within 5 years	0.23 billion
Module A5	Construction of Flood Diversion Channels	• Design and construct flood diversion channels around Bangkok • Improve existing canals and undertake river dredging	3.87 billion
Modules A6 & B4	Data warehouse for water resource management, flood forecasting and warning system	• Establish single command flood management centre • Develop flood forecasting system • Develop flood management • Develop national water data warehouse	0.16 billion
Module B3	Improvement of Main Waterways and Prevention of Erosion along the river banks in the areas of 17 river basins	• Design improvements for waterways and diversion canals in Hat Yai District, Songkla Province • Construction to be completed within 5 years	0.32 billion

Source: WFMC (2013a, 2013b, 2013c, 2013d, 2013e, 2013f, 2013g, 2013h), Bangkok Post (2013a)

It is likely that implementation transaction costs associated with the Plan were estimated to be relatively low and manageable within existing resource allocations for public water management. Despite the fact that the Plan would result in new infrastructure and requirements for new operational and management resources, no additional resources were allocated for the Master Plan sub-work plans on management of water reservoirs, developing a system for flood prevention and mitigation in important areas and improving water management institutions (Kumpa, 2012; NESDB, 2012) (see Table 3-2). Similarly, the sub-work plan for improving public acceptance of the Master Plan and the types of large scale flood management projects included therein was not allocated any additional funding from the emergency decree or other budgetary resources available to the government (NESDB, 2012).

Finally, while there was evidence available to policymakers at the time to suggest that decision and implementation failure costs associated with the Plan could have been high, there is little evidence from the public record analysed for this study that these potential costs were considered in the design of the Plan or the decision to adopt it. The clearest available evidence of this is the fact that a number of long contentious projects were included in the Plan despite the fact that, in some cases, years of consultation had failed to secure the support of important stakeholders (Blake, 2014; Panyawai, 2012; The Nation, 2012).

4.2.5. Summary of the explanatory framework applied to the decision to adopt the Master Plan

Consistent with explanatory framework developed in Section 2, there is reason to believe that in evaluating the adaptation cost trade-off the Thai Government overlooked key costs associated with action, while potentially underestimating others. The catastrophic nature of the 2011 floods and the loss and damage that accompanied this event ensured that estimates of implementation failure costs associated with the current system were relatively high. Meanwhile, decision-making and implementation transaction costs associated with the Master Plan were generally overlooked or deferred. As a result, from a cost and efficiency perspective it is considered likely that the Thai government considered that the reactive adaptation embodied in the Plan involved less cost than maintaining the status quo. While this would not have been the only consideration of the Thai Government when deciding whether or not to adopt the Plan, as noted above, statements released by the Thai Government in the lead up to the adoption of the Plan indicate that improved efficiency of flood protection and mitigation was a concern. A visual overview of the cost trade-off associated with this decision is presented in Figure 4-2.

4.3. Evidence that the Master Plan involved unanticipated costs

4.3.1. Status of the Master Plan and possible issues with the flood response

Despite the scale of the climate threat it was designed to tackle, very little of the Plan has been implemented and its immediate future is in serious jeopardy. Three years after the 2011 floods started to gain momentum in northern Thailand, almost no work has commenced on the long-term flood control and adaptation measures identified in the Master Plan and

associated investment modules (ChosunMedia, 2013; Jikkham & Nanuam, 2014a). The National Economic and Social Development Board recently indicated that as little as 6 per cent of the funding for the Master Plan has been spent (Kumpa, 2014).

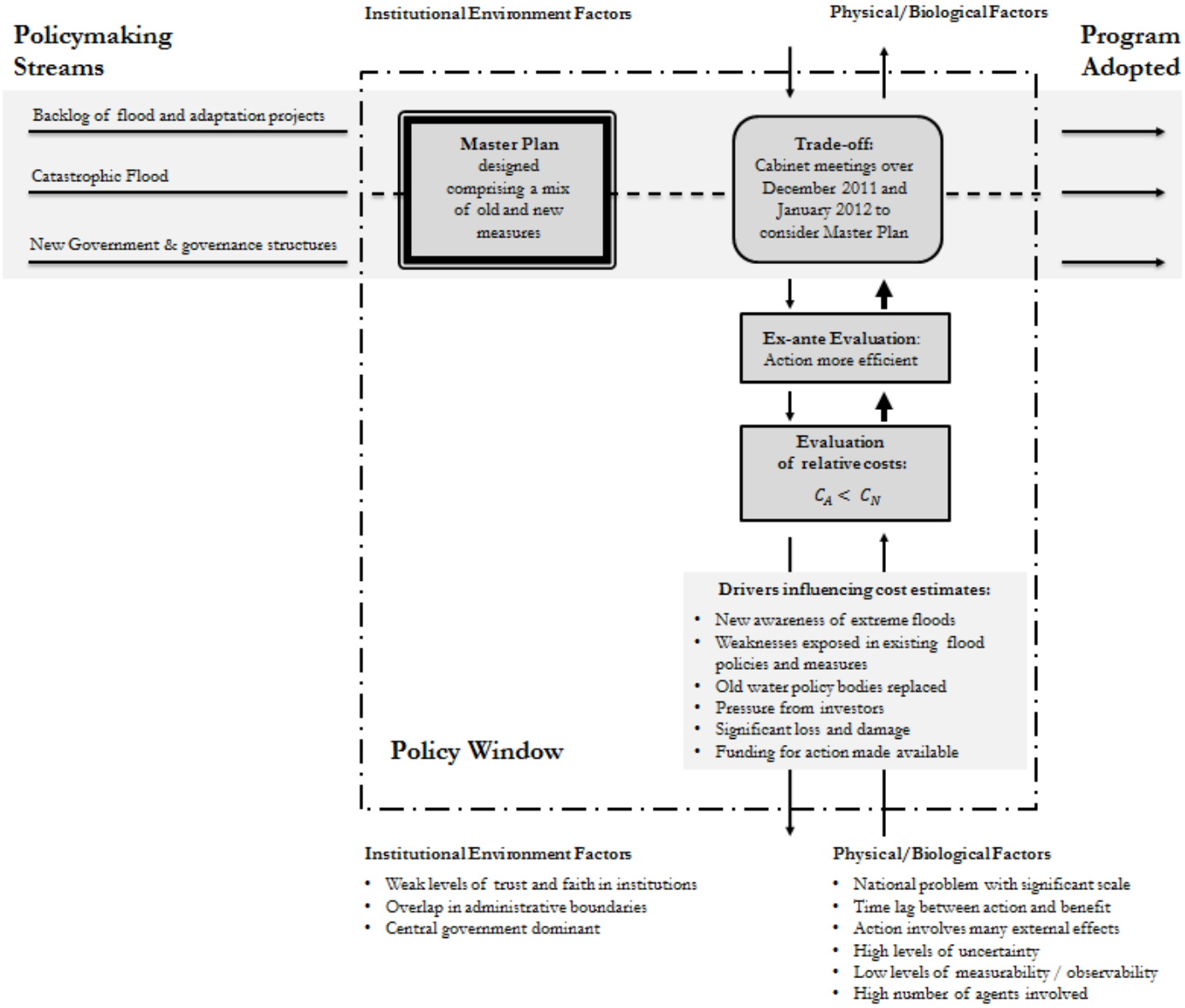

Figure 4-2 Visual overview of the policy window and adaptation cost trade-off that followed the 2011 Thai floods

Following a recent coup in May 2014, one of the first actions of the new military government, the National Council for Peace and Order (NCPO), was to ask the ONWF to re-submit the Master Plan for further review (Jikkham & Wipatayotin, 2014). After its review the NCPO ordered the suspension of all activities related to the Plan (Jikkham & Nanuam, 2014a). The water governance structures established by the previous Thai Government in response to the floods have been scrapped and replaced by an interim Water Management Board (Blake, 2014; NCPO, 2014). While recent news reports indicate that the NCPO may not completely scrap all elements of the Plan, it is almost certain it will be scrapped in its current form with

some elements incorporated into a new national plan for water management (Jikkham & Nanuam, 2014c; Theparat, 2014).

In essence, the adaptation policy program that was designed by the Thai Government to respond to the 2011 floods will not be implemented. In the context of policy windows, the scrapping of the Plan represents a significant missed opportunity for the Thai Government to strengthen the country's capacity to adapt to and mitigate extreme climate events; particularly those resulting from flood. Given the significant resources that were invested in the design and preliminary implementation of the Plan, not to mention the potential avoided damage and loss associated with recent past and future flood events, failure to implement the Plan represents a significant mix of actual and opportunity costs and a poor adaptation outcome for Thailand. It is possible that in this case failure to properly account for transaction and other costs; particularly those necessary to address the concerns of stakeholders affected by the nature of the response, has resulted in this outcome.

4.3.2. Substantial Decision and Implementation Failure costs

Unsurprisingly, due to the way that decision-making transaction costs were managed, the Plan appeared to suffer from significant decision failures. The Master Plan called for a complex mix of highly technical flood mitigation and water management measures that required some level of agreement from numerous stakeholders at a range of geographical, administrative, social and economic scales. Unfortunately, even before the floods struck, the Thai Government's water management agencies had poor reputations for engaging with local communities or employing participatory approaches to water management (Nehru, 2011). Perhaps based on the expectation that community engagement would be conducted by private contractors during implementation of the modules, little consultation was conducted with communities regarding the Plan either before or after it was adopted (Bangkok Post, 2013c; OOSKAnews, 2014). This could explain why highly controversial measures such as the Kaeng Sua Ten and Mae Wong dams were incorporated into the Plan.

Opposition against certain elements of the Plan was apparent from the early stages of the its adoption (Sattaburuth, 2013; The Nation, 2012). Some communities had opposed the hard infrastructure measures in the Plan for decades, believing that they would threaten local livelihoods and traditional food sources, lead to possible relocation of residents and damage natural ecosystems (Bangkok Post, 2013e). However, despite the potential for strong and lengthy opposition, the process established by the Thai Government to implement the Master Plan and investment modules required that all measures be designed, vetted and constructed within five years (WFMC, 2013h).

In early 2013, as the government was engaged in managing the bidding process for the Plan's investment modules, communities started to mobilize resources to try and halt implementation of the Plan. Community groups, NGOs, academics and residents organized protests and confronted government employees and contractors sent to evaluate project sites (Associated Press, 2013; Blake, 2014; Laotharanarit, 2014; The Nation, 2012, 2014a). While the government tried to alter the details of some of these more controversial elements of the Plan, substantial damage had already been done with media reports and commentary

regarding the Plan taking on an increasingly negative and sceptical tone (CleanBiz.Asia, 2013; Panyawai, 2012).

Once the concerns of these stakeholders were taken up by the court system, the Plan was subject to significant unintended costs in terms of legal fees, follow-up consultations and opportunity costs associated with the fact that, perhaps beneficial, adaptation measures were to be delayed and possibly scrapped (Bangkok Post, 2013b; The Nation, 2014a). In July 2013, the Central Administrative Court of Thailand ruled that implementation of the modules, by this time synonymous with the Master Plan, were to be halted until public hearings on each module could be held. The ruling stipulated that environmental and health impact assessments would also need to be completed on each module before any further work on design and construction could proceed (Associated Press, 2013). While some modules had already been subject to such assessments, many of them had not (Bangkok Post, 2013d). The ruling of this court was later supported by judges at the Thai Supreme Administrative Court (The Nation, 2014a).

Court mandated public hearings commenced in October 2013. During the hearings community groups were given only basic information of the measures to be implemented and limited time to voice their concerns (Patsara, 2013). By January 2014 political unrest had seized the country. Meanwhile, the court system continued to mandate that public consultations and completed environment and health impact assessments were required before the Plan could proceed (The Nation, 2014a).

It is considered unlikely that the Thai Government factored the possibility of implementation failure into its estimates of the overall cost of the Plan. However, there is reason to believe that these costs could have been significant. Based on recent meta assessments of the cost effectiveness of dam projects such as those envisioned in the Master Plan it is likely that they would have been subject to significant delays and cost overruns during construction (Ansar et al., 2014). As most of the investment modules involved the construction of hard infrastructure they would have also involved potentially high levels of technology 'lock-in' cost.

It is unclear whether these failure costs were contemplated as part of the decision to adopt the Master Plan, but it is considered unlikely. In their opposition to the Plan, community groups highlighted the potential for the Plan's measures to lead to a range of irreversible social and environmental problems (Bangkok Post, 2013e; Laotharanarit, 2014; Sattaburuth, 2013). Contrary to the objectives of the Plan, these problems may have worked to weaken the adaptive capacity of the communities the Plan was aiming to protect. Interestingly, the nature of the Master Plan was influenced by the Korean Government's 'Four Rivers Restoration Project', which had commenced shortly before the 2011 floods (Bangkok Post, 2012; Ju-hyun, 2013). Experience with the particular project, including environmental damage and significant additional maintenance costs, has demonstrated that the infrastructure-heavy approach envisioned in the Master Plan is susceptible to considerable implementation failure (Card, 2009; Jee-yeon, 2013; Jin-hwan & Young-rule, 2011).

The potentially high implementation failures embedded in the Plan has also been corroborated by independent evaluation. In early 2013, a study on the flood control measures identified in the Master Plan commissioned by the Japanese Government concluded that many of the measures were not required (Wangkiat & Jikkham, 2013). While the report confirmed that the measures included in the investment modules would improve flood protection and mitigation, it also concluded that similar levels of flood mitigation could be achieved at less than half the cost of the Master Plan (NESDB et al., 2013). These findings may have indicated that the Thai Government overreached in the design of the Plan's measures.

The narrow focus of the Plan on flood may have also resulted in sub-optimal climate change adaptation outcomes. Although flood continued to be a primary concern following the 2011 floods, many experts had also started to draw attention to Thailand's growing drought problem (Bangkok Post, 2014; Roughneen, 2012; Wipatayotin, 2012). By mid-2014 news reports were focused solely on a very different type of crisis to that which gripped the country in 2011 as many communities in the north of Thailand struggled to access water for basic services (Bangkok Post, 2014; Nanuam, 2014; Singha, 2014a, 2014b). These reports drew attention to the lopsided nature of the Master Plan, which, some considered, focused too strongly on flood but did not give equal consideration to problems associated with drought (The Nation, 2014b). From a climate change adaptation perspective, this could be considered a significant oversight in the design of the adaptation measures included in the Plan.

4.4. Summary analysis – Did the Master Plan result in poor adaptation outcomes from a cost and efficiency perspective?

Consistent with the theories developed in Section 2, there is evidence to suggest that in considering the relative costs of action Thai policymakers overlooked or underestimated key transaction and other costs associated with the Master Plan. As a result, the estimated costs of the adaptation measures included in the Master Plan, while significant, were likely to be considered far less than the unprecedented estimates of loss and damage that resulted from the floods and the failure of the prevailing water management system to cope with them. Adaptation drivers of the policy window that followed the flood including heightened awareness of climate extremes, weaknesses with prevailing policies and management systems and pressure from external stakeholders, may have increased perceptions of the magnitude of the opportunity costs of inaction and strengthened support for the Plan (Table 4-3). However, while the opening of a policy window in response to the 2011 floods facilitated an adaptation response, the evidence suggests that the Plan adopted resulted in poor adaptation outcomes from a cost and efficiency perspective.

A possible explanation behind the poor performance of the Plan is that the Thai government failed to properly account for and manage the full transaction and other costs involved in the design and implementation of the adaptation measures contained in the Plan (Table 4-4). The decision-making transaction costs required to effectively design a complex, large scale adaptation program such as the Master Plan were underestimated. There is evidence that few resources were invested in designing the specific elements of the Plan or seeking feedback

from stakeholders on the Plan's measures prior to or after the decision to adopt it. Some key processes, such as stakeholder consultation and impact assessments, and sensitive issues, such as land reclamation, were deferred until the implementation phase of the Plan and left to be managed by private contractors. The government's poor management of decision-making processes was later reflected in substantial and costly decision failures. Key stakeholders who complained of being poorly consulted increasingly opposed the Plan, which led to significant implementation costs including legal action and delays.

Table 4-3 Summary Assessment of the Costs of Inaction associated with the status quo water and flood management system in Thailand

Cost Variable	Explicitly considered in cost trade-off?	Summary of evidence
Costs of Inaction		
Implementation failure costs of inaction (F_I^n)	*Yes* *US$46.5 billion*	• Likely that costs may have been considered higher if incidence of future flood was considered • Recent occurrence may have raised expectations that a similar event would occur in the near future
Implementation costs of inaction (T_I^n)	*No*	• Little evidence available • Complexity of water governance system in Thailand implies that these costs may be large and could be streamlined
Benefits foregone (O^n)	*No*	• Unlikely these costs were considered explicitly • Flood of a similar magnitude has not occurred since2011 • However, flooding and drought are persistent problems

While very little of the Plan had been implemented when this research was undertaken, there is also evidence that the implementation failure costs resulting from implementation of the Plan could have also been high. It is likely that these costs would have grown should implementation of the Plan continued. The hard infrastructure called for in the Plan also likely involved significant technological 'lock-in' costs that would not have been apparent until sometime after the implementation of the Plan. Independent research which indicated that many of the Plan measures were unnecessary and failed to properly account for other climate related problems such as drought vindicated the concerns of stakeholders and further supports a finding that decision-making costs were underestimated and inadequately managed.

The recent scrapping of the Plan, reportedly in response to continuing stakeholder opposition, now means that the resources that were invested in in its development and early implementation over the period from October 2011 until May 2014 have largely been lost (Jikkham & Nanuam, 2014b; Jikkham & Wipatayotin, 2014). Perhaps more troubling is that adaptation measures which may have improved Thailand's capacity to better cope with the impacts of climate change and extreme climate events have been delayed indefinitely and may not be implemented at all. Ultimately, the resources invested by the Thai Government to adopt reactive adaptation in response to the 2011 floods have resulted in no or very little

improvement in Thailand's capacity to address extreme climate events such as the combination of precipitation events that triggered the crisis in 2011 or other climate-related challenges such as the drought that has gripped northern Thailand for the better part of 2014.

Table 4-4 Summary Assessment of the Costs of Action associated with the Master Plan

Cost Variable	Explicitly considered in cost trade-off?	Summary of evidence
Costs of Adaptation		
Production or Transformation Costs (P^a)	*Yes* *US$9 –US$11 billion*	• It is unclear how the final estimate of the cost of the Master Plan measures was calculated • Technological 'lock-in' costs not considered • Potential for delays and cost overruns not considered
Decision-making Transaction costs (T_D^a)	*Yes, but limited*	• Few resources invested in research, design and consultation • Plan was developed quickly and few details were made available • Government transferred many decision-making costs to private contractors
Implementation Transaction Costs (T_I^a)	*Unclear*	• Contracting arrangements of the Plan were subject to delays • Management costs associated with monitoring and enforcement not considered
Decision Failure Costs (F_D^a)	*No*	• Poor stakeholder consultation led to mistrust and opposition to the Plan • Subsequent legal challenges led to significant delays and, possibly, termination
Implementation Failure Costs (F_I^a)	*No*	• Evidence suggest that not all measures in Plan were required • Plan employed narrow focus that failed to properly account for other climate related problems such as drought

In this Section the explanatory framework developed in Section 2 was applied to the particular case of the 2011 Thai floods and the response adopted by the Thai Government; in particular the adaptation elements of the Master Plan on Water Resources Management. The floods were found to open a policy window allowing for a substantial policy program to improve capacity to strengthen resilience to and reduce vulnerability to future incidence of flood in the Chao Phraya River Basin. Based on an assessment of relevant documentary evidence it was found that the way that the Thai Government specified and managed

transaction and other costs in designing and implementing the Master Plan resulted in significant program delays, additional consultation costs and likely termination of the program. Additional evidence was presented to suggest that these poor outcomes resulted because Thai policymakers overlooked or underestimated important costs associated with the Master Plan, which led to a number of crippling decision and implementation failures.

5. Discussion

In this Section the findings from application of the framework are discussed to determine their relevance and explanatory potential with respect to the main research questions. The Section proceeds as follows. Firstly, the findings of the explanatory framework and case study developed in the previous Sections are discussed to consider their relevance and usefulness in addressing the research questions. Consideration is also given to the limitations of the approach adopted. As noted previously, to try and strengthen the validity of the findings in the Thai case study, a congruence analysis approach was adopted to compare key conclusions from this case study with the expected results from the application of other methods. Following consideration of the limitations, the findings of the congruence analysis are presented. Finally, some general lessons learned for the development and implementation of reactive adaptation in response to extreme climate events are presented along with suggestions for further research.

5.1. Relevance of findings and analysis

5.1.1. Relevance of findings and analysis

The findings and analysis presented in this thesis suggest that the explanatory framework developed in Section 2 may be useful in illuminating why reactive adaptation in response to extreme climate events can lead to poor adaptation outcomes; particularly from a cost and efficiency perspective. A key finding is that the way policymakers estimate and manage transaction costs during the decision-making process can influence the overall success of the adaptation program adopted. The framework suggests that when presented with a policy window following an extreme event, adaptation drivers work to facilitate action and encourage policymakers to overlook and underestimate key costs. Failure to properly account for and manage the costs involved in the design of the adaptation policy program leads to significant actual and opportunity costs associated with delays and adjusting measures to better account for the concerns of neglected stakeholders.

The relevance of these theories was confirmed by application of the framework to the Thai case. In this case, pressure to adopt a long-term response to restore confidence in the Thai economy and changes to prevailing governance arrangements led to the speedy development of an infrastructure heavy adaptation policy program that was poorly vetted amongst key stakeholders and light on details. When compared to the considerable loss and damage suffered as a result of the floods, it is likely that the Plan was considered a timely and efficient way to further the national adaptation agenda. The relatively little time and resources dedicated to decision-making transaction costs resulted in substantial decision failures and potential for high future implementation failures.

The Thai case represents an extreme case in the sense that the Thai Government's efforts to expedite development of the Plan and failure to properly account for the costs involved with its design and implementation have likely been contributing factors in its recent scrapping. From a cost and efficiency perspective, the Plan resulted in particularly poor adaptation outcomes including substantial opportunity costs associated with wasted resources and the

loss of an opportunity to strengthen longer term capacity to cope with climate-related threats including flood and drought.

5.1.2. Limitations of the framework

While it would appear that application of the explanatory framework in the Thai case was able to provide a credible explanation as to why reactive adaptation in response to extreme climate events may result in poor adaptation outcomes; particularly from a cost and efficiency perspective, there are a number of limitations that should temper any conclusions regarding the broader relevance and applicability of the framework. A pivotal element of the framework is the assumption that policy windows resulting from extreme climate events result in adaptation drivers that influence the way policymakers will evaluate the costs involved with a given trade-off. Based on the framework, a number of theories have been developed about the way that these drivers will shape cost estimates. While it is reasonable to assume that these drivers influence the way that policymakers estimate the costs associated with adopting reactive adaptation in response to an extreme climate event, the exact nature of this influence was difficult to document and verify with the methods employed in this research. Evidence of the influence of these drivers was, however, apparent in the Thai case. But, additional primary information from policymakers directly involved in the decision-making process would have better illuminated the nature of this influence.

A related limitation of the framework is that it was designed to investigate the specific problem of why reactive adaptation in response to policy windows opened by extreme climate events may result in poor adaptation outcomes. As described in Section 1.2, this research problem was identified based on evidence put forward by the IPCC and supplementary literature which indicates that reactive adaptation in response to extreme climate events results in poor policy outcomes (Adger et al., 2007, 2005; Christoplos, 2006; Dovers & Hezri, 2010; B. W. Head, 2014; Heintz et al., 2012; Jeffers, 2011; Jonkman & Dawson, 2012; Penning-Rowsell et al., 2006; O. Williamson, 2000). In the course of undertaking this research it was difficult to identify examples of reactive adaptation in response to an extreme climate event that potentially resulted in positive adaptation outcomes. Generally, in the specific case of floods, examples of best practice flood risk management in the literature tended to highlight the strong role that planning, preparation and preemption play in effective responses to instances of flood (Heintz et al., 2012; Sun et al., 2012). Based on the different types of adaptation identified in Section 1.1, this type preemptive action could not be categorized as reactive adaptation. It would more appropriate to categorize it as planned adaptation.

However, despite the relevance of the research problem and difficulty in finding potential cases of successful reactive adaptation to extreme climate events, a valid criticism of the framework developed here is that may risk ignoring the possibility that reactive adaptation in such situations can lead to positive outcomes. Many elements of the framework developed for this thesis, such as the adaptation drivers that arise in response to policy windows that open in response to extreme climate events, are value neutral and would likely drive both successful and unsuccessful reactive adaptation. In this way the framework would not preclude the possibility of positive reactive adaptation outcomes. However, the particular

interpretation of the framework employed to investigate the research problem identified for this thesis is oriented toward understanding why reactive adaptation may lead to poor outcomes. This could have produced some bias in interpreting the case study findings. While no examples of successful reactive adaptation in response to extreme climate events were found or considered in undertaking the research for this thesis, there is no reason to believe that such examples do not exist. A useful area for further research would be to identify and investigate how the framework developed in this paper may apply to such examples and compare and contrast the results with reactive adaptation that resulted in poor outcomes such as the Thai case presented in this thesis.

5.1.3. Limitations in application of the framework

Perhaps unsurprisingly, the case study research method, which relies on the analysis of secondary, documentary sources, is unsatisfying. Lack of detailed information regarding potential proxy values meant that the findings and analysis, while rooted in theory related to cost, produces very few cost estimates to further support the findings and analysis. While measurement was considered outside the scope of this research, eventually some level of measurement will be necessary to draw any wider conclusions about the applicability and usefulness of the framework and to test theories derived from it (Birner & Wittmer, 2004).

Similarly, while the evidence supported a narrative that was largely consistent with the framework developed in Section 2, the types of documentary evidence used in the analysis provide additional reason to consider the findings as tentative. The findings are based almost solely on documents that are available in the public record and in English. While in this case there was a rich documented history of both the 2011 floods and the Thai Government Master Plan in English, lack of access to specific decision-makers and government documents should be considered a significant limitation of the approach. Access to additional information related to specific Cabinet papers or persons involved in the decision-making process may have produced further information to support or refute the findings presented. Relying on local news sources that are published in English such as the *Bangkok Post* or *The Nation* also opens the analysis up to potential editorial bias that may influence how particular issues are reported.

5.1.4. Weak ability to generalize

As noted in Section 1, small sample case studies such as the one presented here suffer from weak generalizability. Thus, although the framework provided some insights into the way that considerations of cost may have influenced the poor performance of the Master Plan, whether it is applicable to other instances of policy windows resulting from extreme climate events cannot be satisfactorily determined based on the research presented here.

Case study selection should also be considered a particular problem as it is likely that the 2011 Master Plan represents an extreme case of poorly designed and implemented reactive adaptation. The fact that the Master Plan was scrapped lends immediate and strong credibility to frameworks and theories such as the ones developed in this thesis, which attempt to explain why reactive adaptation in response to extreme climate events leads to poor adaptation outcomes. However, whether the framework would provide insight into

other, less dramatic examples of failed reactive adaptation cannot be properly tested in the context of this thesis. There is a strong possibility that other, perhaps unique factors or mechanisms operating outside the application of the framework developed in this thesis also provide an equally compelling explanation of the poor performance of the Master Plan.

On a related note, the ability to make broad inferences about the applicability of the framework to other examples is further restricted by the conceptual foundations underpinning the framework. As the framework was designed to investigate issues surrounding the policy windows hypothesis as applied to extreme climate events, it is necessarily rooted in the concepts unpinning this theory of policymaking. However, policy windows are only one specific way of imagining the policy development process.

Like most theories regarding the policymaking process, the theory of policy windows aims to simplify the complex changes in human behaviour that lead to policy change (Johnson et al., 2005). Johnson et al. (2005) convincingly argue that because policy change is the result of changes in human behaviour there are numerous different ways this phenomenon can be conceptualized and assessed. As a result, when seeking to better understand policymaking, policy development and policy change it is necessary to apply an integrated method combining insights from a range of different approaches. As a result, and consistent with the aims of congruence analysis, Section 5.2 is dedicated to considering how other analytical methods may strengthen the validity of the framework and findings presented here and contribute to the broader theoretical discourse surrounding reactive adaptation, policy windows and extreme climate events.

5.2. Drawing insights from alternate theories of reactive policy development and governance

5.2.1. Policy Change theory

Johnson et al.'s theory of policy change is an integrated approach drawing together elements of theory from policy windows and action coalition frameworks to test whether floods could be considered 'catalytic' events that accelerate changes in prevailing flood management policies. It postulates that the policy process is generally characterized by relative stability involving incremental policy changes. However, this stability is punctuated by times of rapid change. During these times such as the occurrence of a national flood event, catalytic changes in policy are possible due to the potential for such events to draw new actors to a problem and generate new policy ideas and approaches (Johnson et al., 2005).

To test the theory it was applied to four cases of national flooding in the United Kingdom. It was found that the impact of floods on policy change is dependent on a combination of specific contextual, behavioural and environmental 'drivers' (Johnson et al., 2005). These drivers include the magnitude of the flooding event and its impact, the availability of information and technological solutions, the socio-economic, political and governance structures in place and the dominant attitudes and beliefs of the society toward flood hazards.

While the authors found that flooding events were indeed opportunities to enact policy change, owing to the influence of prevailing attitudes, beliefs and key policy players it was

considered unlikely that such events lead to the adoption of genuinely new policy solutions. In addition, the authors found that the government agencies or governance arrangements put in place to address the flooding event will have a strong influence on the type of response adopted. In the cases evaluated, new policy ideas that emerged from new policy actors drawn in by an extreme climate event were often mediated through a group of prominent actors who were deeply involved in past flood management policy. Thus, the changes in policy that resulted were contingent upon the issues, actors and ideas seen as important before the flood (Johnson et al., 2005). These findings were later corroborated by Penning-Rowsell et al. (2006) who used the findings of Johnson et al. to identify and investigate 'signals' from pre-flood discourses that could reveal the direction that policy might take following the occurrence of such an extreme climate event. Their analysis of public records pertaining to the same events assessed by Johnson et al. found that the flooding events accelerated the development of policies that had been the focus of deliberation some time before the floods occurred (Penning-Rowsell et al., 2006).

Many of the concepts applied in the work of Johnson et al. and Penning-Roswell et al. were also touched upon in the work of Jeffers (2011) and Albright (2011) who examine policy responses to flooding events in Ireland and Hungary, respectively. Their work further corroborates conclusions that policy responses to flood events will tend to be shaped by policy discourses prevailing before the occurrence of a flooding event.

An interesting element of Jeffers work is that he considered the role that implementation failure; particularly that resulting from reliance on hard infrastructure and quantitative risk management, can play in shaping post-flood policy responses. Jeffers found that these types of approaches to mitigating extreme climate events privilege the knowledge and opinions of a relatively small group of technical experts. This was found to lead to policies that are limited in scope and designed for coping with past events. Based on comparative experience with responses to past flood events it was concluded that such reactive experientially-based responses are unlikely to facilitate effective adaptation because past experience may be a poor indicator of future climate risk (Jeffers, 2011). Albright arrived at similar conclusions. She found that extreme climate events may shift political resources necessary for policy change to occur, but that it is likely that policy adopted will tend to follow a dominant belief system (Albright, 2011). Two belief systems were identified. One rooted in long-standing, traditional engineering approaches to flood and water management and another more nascent ecological approach (Albright, 2011).

This work offers useful insights into the framework and case study presented in this thesis. Although also based to some extent on the theory of policy windows, findings from the application of policy change theory would seem to indicate that the policy window is a useful concept for explaining policy changes in response to an extreme climate event. Johnson et al.'s findings regarding policy 'drivers' associated with extreme climate events also seems to corroborate the potential importance accorded to the adaptation drivers of policy windows identified in this thesis. The policy drivers identified by Johnson et al. are broadly defined and easily encompass the more specific features of policy windows outlined in this thesis. These findings also lend further credibility to the approach employed in this thesis of trying

to infer how these drivers may affect the ways that policymakers evaluate a potential policy response.

Policy change theory also offers insights into the relative magnitude of different types of cost associated with an adaptation trade-off. Johnson et al., Penning-Roswell et al. and Albright's work implies that institutional 'lock-in' costs associated with the status quo and any proposed policy program will be high. As a result, the likelihood that significant 'new' policy change will follow an extreme climate event is generally low. If the prevailing water governance system favours hard infrastructure and risk management approaches to extreme climate events, it is likely that the occurrence of such an event will catalyse this type of response. In this way an extreme climate event will generally encourage policymakers to overlook or underestimate the technology 'lock-in' costs associated with these adaptation responses. Jeffers work also suggests that the implementation failure costs associated with such approaches will be high; particularly if the response relies on past experience and fails to accommodate potential for future uniquely catastrophic events.

This literature provides additional useful insights into the Thai case. At first it could appear that Johnson et al., Penning-Roswell et al., Jeffers and Albright' findings regarding the role of extreme climate events as catalysts of existing policy discourses runs contrary to the findings in the Thai case; particularly because the Mater Plan was developed by the new governance structures that quickly developed during the flooding. However, as outlined in Section 4, while it is true that numerous new water governance structures were created in response to the floods, it is also true that they were generally comprised of prominent, well established figures in Thailand's past water governance regime (Sullivan, 2012; TPRD, 2011f; Withitwinyuchon, 2011). Using the terminology devised by Albright, it is likely that the policymakers involved in the development of the Plan still subscribed to the long-standing, traditional engineering belief systems of flood and water management that had characterised Thailand's water sector in the past (Molle, 2007; Sneddon, 2002; The Nation, 2013a).

When viewed in this light it is also not surprising that many long standing and sometimes controversial measures were incorporated into the Master Plan. Thus, while the implementation failures manifest in the floods may have weakened the standing of some policymakers, it may have also strengthened the influence of another group of actors advocating similar solutions. Expressed another way, the 2011 floods provided the means to catalyse a number of difficult, hard infrastructure solutions that had been floating in the policy stream for some time. In addition, this illustrates that when applied to the Thai case the findings from the policy change literature are also consistent with the concept of coupling. The policy change literature also seems to lead toward a conclusion that the technology 'lock-in' and potential implementation failure costs associated with the Master Plan would have been particularly great. This is further supported by literature on the potentially high social and environmental costs of large scale dam and hydropower infrastructure (Ansar et al., 2014; Brown et al., 2009).

5.2.2. Scale and Adaptive Water Governance

Theories of scale also provide a number of useful additional insights into the framework and findings presented in this thesis. According to Molle (2007, pp.359) scales are social and political constructs employed by individuals, organized groups or government bodies to frame problems and suggest solutions in an attempt to influence policy and the way resources are managed. Scale analysis follows a mode of explanation that evaluates the influence of variables acting at a number of scales and how different social actors constrain, create and shift scales to enhance their relative power and authority over a particular resource (Lebel et al., 2005; Robbins, 2004). Scale analysis is often applied in the literature to investigate conflicts linked to water resources and water management policies (Del Moral & Do Ó, 2014; Houdret et al., 2013; Lebel et al., 2005; Molle, 2007; Sneddon, 2002). Conflict regarding water policy interventions is common. Water is an essential, fluid resource. As a result, interventions at a particular spatial or political scale may result in unintended impacts at other scales, which are likely to result in externalities that impact on a range of actors (Lebel et al., 2005).

Actors negotiate such conflict by trying to influence discourses at different scales and alter access to resources and corresponding decision-making processes (Lebel et al., 2005). Where scale privileges one actor over others there may be a tendency to shut out or neglect stakeholders operating at other scales. For example, diversion and damming of water resources upstream may restrict certain actors' access to water resources downstream increasing the possibility of conflict or opposition. Here upstream users may decide to neglect or exclude downstream users to preserve their interest with relation to the resource. Similarly, policy action at a national level to prevent future instances of flooding with large scale infrastructure upstream may adversely impact on local communities living near a proposed dam site. This may encourage policymakers to restrict the access of such communities to decision-making processes.

Adaptive water governance has been suggested in the literature as one possible way to address the issues associated with scale conflict. This concept is rooted in the idea that governance failures are at the origin of many water resource problems (Pahl-Wostl, 2009). Adaptive water governance embraces the uncertainty and complexity of water resource management through improved knowledge generation, transparency and wider involvement of stakeholders in co-management structures that share decision-making over a given resource amongst a range of stakeholders (Birner & Wittmer, 2004; Pahl-Wostl et al., 2012).

A key element of adaptive governance is policy learning through experimentation (Folke et al., 2005). A natural consequence of adaptive governance regimes that rely on experimentation and trial and error is a tendency to opt for policies and measures that are flexible and minimize significant 'lock-in' costs. In a flooding and adaptation context this may result in approaches that aim to accommodate water through strategies such as 'space for the rivers' and 'managed retreat' to reduce the impacts of flood (Mees et al., 2013). As a result, such approaches that rely less of traditional infrastructure and flood and water control measures, may involve less production costs, but significantly more decision-making costs.

Concepts of scale theory have obvious relevance to the framework developed in this thesis. Disparities in access to and control over water resources at different scales reflect the complex mix of institutional and physical/biological factors that provide the context to any policy window. An extreme climate event will allow actors at different scales an opportunity to pursue solutions that play to their interests at their respective scales. Competition for control of the discourse surrounding a given event may lead actors to neglect or overlook the concerns of actors at other scales. This may be reflected in reduced decision-making costs and subsequent decision and implementation failures.

Disparities between actors at different scales also highlight a more fundamental issue underpinning the framework; namely that win-win solutions will generally not materialize and that some trade-off will be required (Middelkoop et al., 2004). This implies that in order to minimize failure costs consultation and negotiation costs will be required regardless of the policy mix chosen. The example provided by adaptive water governance implies that alternative, stakeholder inclusive approaches will likely necessitate significant decision-making costs for research and responding to feedback. But forgoing such costs implies conflict and potential decision and implementation failure costs.

Drawing on the Thai case study as an example, the governance sub-system of the Chao Phraya River Basin results from the interaction of community stakeholders, local and provincial governments, river basin committees and national government agencies each organized according to different scales represented by administrative boundaries and/or spatial and biophysical features of the water resource (Pahl-Wostl et al., 2012; Sneddon, 2002). The Thai Government operates at a national political and spatial scale, while provincial and local governments naturally work at lower scales. Depending on the scale, each actor will have different concerns and motivations. According to the theories of scale, each of these actors vies for influence over the Basin's water resources at different political and spatial scales.

Tensions between actors at different spatial and political scales may have had a significant influence on the Thai Government's response to the 2011 floods. For example, analysing scalar discourses can shed light on the hard infrastructure, flood mitigation focus of the Master Plan. Economic development has been the guiding and overriding principle of water resource management at the national level in Thailand (Molle, 2007; Sneddon, 2002). Previous research indicates that the importance of the Thai capital, Bangkok, and the surrounding lower Chao Phraya delta for the country's economic development has resulted in a tendency for water policy to privilege and protect these areas (Molle, 2007). As a result, anxiety regarding the threat of flood has been used to justify the construction of dams and control infrastructure in upstream basins with poor levels of stakeholder acceptance and legitimacy (Lebel et al., 2005; Molle, 2007; Sneddon, 2002).

As the floods approached Bangkok in September and October 2011, government representatives and national media seized hold of the floods and transformed them from a local issue that had been affecting communities in the northern Chao Phraya River Basin into a national catastrophe requiring a significant government response (Phoonphongphiphat & Petty, 2011; TPRD, 2011a; Win, 2011). This change represented a shift in the public

discourse with respect to the floods that signalled the responsibility for responding to the floods would be assumed by national agencies; specifically the newly formed SCWRM. The anxiety regarding flooding in the delta is a plausible reason why the SCWRM devised a plan that was comprised largely of costly, hard infrastructure measures that aimed to protect the lower basin from future flood events as opposed to more inclusive flood management policies involving feedback from a wide range of stakeholders in the lower and upper basin.

Scalar discourses can also provide insight into why the Plan was able to be so effectively delayed and later scrapped. Opposition to the Plan was generally focused on a few particularly contentious measures and the perception that the method of financing the Plan was susceptible to corruption (Blake, 2014; Sattaburuth, 2013; The Nation, 2012, 2013a). Once implementation of the Plan commenced local, communities and advocacy groups seized contentious elements of the Plan to try and change the discourse surrounding the Plan. Opposition from local communities and advocacy groups to measures such as the Kaeng Sua Ten and Mae Wong Dams slowly began to transform the discourse surrounding the Plan from that of a necessary, long-term response to catastrophe into one of the national government overreaching and cutting corners at the expense of local communities and transparency (Blake, 2014). The narrative thrust of this argument was later taken up by the courts and, more recently, Thailand's new military government as reason to delay and review the Plan. Thus, communities were able to effectively leverage the discourses available to them at the local level to influence the national discourse surrounding the Plan and eventually scuttle it.

Applied understanding of these scalar discourses may have helped policymakers avoid the significant decision and implementation failures resulting from the Plan. The theories of scale analysis complement the findings in Section 4 that the Thai Government's decision to fast-track the development of the Plan without providing due attention to decision-making costs involving consultation and negotiation with stakeholders at other scales may have led to high, possibly insurmountable failure costs and poor adaptation outcomes. Clearly more time and wider consultation was required to develop a Plan of the type encapsulated in the Plan. Although the institutional infrastructure was in place for a more consultative approach to developing the Master Plan, the Thai Government opted for a more centralized policy development process. While Thailand has officially decentralized water governance to RBCs and decision-making bodies and administrative units at sub-national levels, the evidence presented in this thesis suggests that these bodies were largely ignored during the development of the Master Plan. Stronger involvement of these bodies may have been able to mitigate or reduce some the decision and implementation failures that later characterized the Plan.

Table 5-1 Summary of supplementary findings from congruence analysis

Finding	Relevant Alternate Theory	Supplementary Finding
Framework		
Extreme climate events such as floods are policy windows	Policy Choice	• Policy windows are a useful concept for explaining policy changes in response to an extreme climate event
Policy windows open in a context of institutional and physical/biological factors	Scale	• Disparities between concerns of actors operating at different spatial and political scales will normally make adaptation action difficult
Policy windows that open in response to extreme climate events possess adaptation drivers that will influence policies adopted	Policy Choice	• Policy change is dependent on a combination of specific contextual, behavioural and environmental 'drivers'
Certain costs associated with adaptation cost trade-off will be overlooked or underestimated	Policy choice Scale Analysis Adaptive Water Governance	• Institutional and technology 'lock-in' costs may be underestimated • Policy change contingent upon the issues, actors and ideas seen as important before an event • Prevailing preferences for traditional, hard infrastructure approaches will be catalysed • Approaches that rely less on traditional control measures, may involve less production costs, but significantly more decision-making costs
Case Study		
Master Plan reliance on traditional hard infrastructure measures may have resulted in unforseen costs	Policy Choice	• 2011 floods catalysed a number of difficult hard infrastructure solutions that had been floating in the policy stream • The technology 'lock-in' and potential implementation failure costs associated with these measures could have been particularly high
High decision and implementation failures costs associated with the Plan were the result of little attention given to decision-making costs	Scale	• Anxieties of flooding in the nation's capital combined with the significant loss and damage that resulted from the 2011 floods led to centrally developed, nationally focuses plan • Communities who were left out of the planning process transformed the discourse surrounding the Plan from positive to negative • Delays and costs resulted

5.3. Proceed with Caution: A summary of lessons learned

Despite the limitations associated with the analysis presented in this thesis it is possible to identify some lessons that may be of use to policymakers faced with the task of developing a long-term adaptation response to an extreme climate event. The findings of this research suggest that when an extreme climate event strikes there are a number of adaptation drivers at play that should be at the forefront of policymakers' attention before deciding on a particular course of action. In particular the sense of consensus for decisive action in response to an extreme climate event should be resisted and not be used as a premise for reducing or avoiding important research and consultation processes necessary for policy development. Avoiding such processes is likely to lead to significant decision and implementation failures and poor adaptation outcomes. From a cost and efficiency perspective, these failures will be manifest in opposition, legal challenges, implementation delays and, potentially, program failure.

A related lesson is that governments should not underestimate the value of planning and associated costs in an adaptation context. An important finding that was drawn out of the congruence analysis relates to the way that policy is coupled with the problem associated with a particular event. Policy coupling means that it is highly likely that the policy measures to be proposed in response to an extreme climate event already exist somewhere in the policy sphere. Thus reactive adaptation to an extreme climate event will most likely reflect the policy options already floating around a particular problem.

This highlights the importance of effective adaptation planning frameworks and the need to ensure following an extreme climate event governments have the potential to access a series of relatively well vetted policy responses that can be tailored and deployed in the aftermath of an extreme climate event. This research suggests that the presence of pre-emptive policy options may be able to reduce the likelihood that decision-making costs are neglected in the urge to take advantage of policy windows that open in response to extreme climate events. Countries are already investing in such frameworks with processes related to National Adaptation Plans of Action (NAPA) and National Adaptation Plans (NAP). More specifically, in the case of extreme climate events related to flood countries are also developing flood risk management plans and frameworks that appear to promise improved responses to such events (Heintz et al., 2012; Jonkman & Dawson, 2012; Sun et al., 2012). The availability of these responses will allow governments to act quickly without neglecting the decision-making transaction costs necessary to avoid significant decision and implementation failures.

The value of the framework outlined in this thesis is that it attempts to provide a comprehensive overview of all of the actual and opportunity costs that policymakers should factor in their decisions regarding the whether or not to adopt an adaptation response to a given extreme climate event. It also highlights that regardless of the circumstances, action and inaction involves costs. While all of these costs may not be able to be quantified, a conceptual understanding of the costs involved with reactive adaptation and how estimates of these costs can be influenced by the adaptation drivers that emerge from policy windows,

will help policymakers avoid falling into the trap of believing that adaptation policy in response to extreme climate events is a low-cost and naturally efficient course of action.

As extreme climate events do represent important windows of opportunity to advance an adaptation agenda, when presented with the opportunity to develop reactive adaptation in response to such an extreme climate policymakers should proceed, but do so with caution.

5.4. Directions for further research

As noted in the discussion above, the conclusions presented in this thesis should generally be considered tentative and require further research. In particular, to determine the usefulness of the explanatory framework developed in this thesis it is necessary to apply it to other cases of policymaking in response to extreme climate events. It would also be useful to compare how the framework applies to cases of extreme climate events other than flood. A number of well-documented historical examples should be available for this further research. To address some of the limitations identified above it would be advisable to expand the research methods to include the collection of primary data from policymakers involved in the target policy development process. It would also be useful to understand how the framework may apply to cases of reactive adaptation that have led to positive adaptation outcomes.

Further insights into the usefulness of the framework would be possible if quantitative and empirical methods were better integrated into the analysis. As discussed in Section 2, the application of such methods is complicated by inherent challenges associated with quantifying many of the costs included in the framework. But, more effort to quantify key costs such as those associated with consultation and negotiation using credible proxy values would allow policymakers to better assess the trade-offs associated with avoiding potentially more costly decision and implementation failures. Documenting evidence of certain costs such as staff time dedicated to consultation and coordination activities and associated costs will provide useful material to better assess and benchmark decision-making costs. Other costs such as decision and implementation failure costs or the benefits forgone of not adopting a particular response will be more difficult to quantify. However, it may be possible to develop qualitative indicators that could be useful in understanding how policymakers' perceptions of costs may influence their willingness to act in response to an extreme event. The approach outlined by Garrick, et al. (2013) to incorporate a qualitative measure of sustainability into transaction cost frameworks similar to the one developed in this thesis may prove useful in this regard. In any event, the work presented here offers a number of possibilities for further useful research to improve the overall performance of adaptation policy.

Finally, as noted in Section 4, the findings presented in this thesis regarding the Thai case study should be considered tentative at best. Further investigation of this case with greater use of empirical evidence would help strengthen the conclusions reached in this thesis. Also, the findings of the congruence analysis suggest that further analysis of the Thai Government response to the floods using theories of scale and stakeholder theories may provide useful supplementary insights into the success of the Master Plan from an equity and legitimacy perspective. The methods and theories employed by Abdollahian & Alsharabati (2003),

Albright (2011), Burke (2001), Lebel et al. (2005), Lubell (2003), Molle (2007), Sneddon & Fox (2006), and Sneddon (2002) may be useful starting points for such further research.

6. Conclusions

With this thesis the author aimed to investigate why reactive adaptation in response to policy windows opened by extreme climate events may result in poor adaptation outcomes; particularly from a cost and efficiency perspective. This investigation involved three steps. Firstly, an explanatory framework was developed based on concepts related to policy efficiency, new institutional economics and transaction costs. According to the explanatory framework, an extreme climate event leads to the convergence of the three policymaking streams – Problem, Policy and Political – that opens a policy window to enact an adaptation policy program. Through a process of coupling one or a number of adaptation policy options emerge from the policy stream to form a policy response that is matched with the political will to adopt it. From a cost and efficiency perspective policymakers will be inclined to adopt the response that will involve the least overall cost. The costs of action, in this case adopting a policy program, and inaction involve a mix of transaction, production and opportunity costs.

A given policy window and the cost trade-off are themselves nested within a physical/biological and institutional context. Due to the complexity of adaptation problems that often require extensive collective bargaining and involve high levels of uncertainty, it normally would be expected that the estimated costs of action are relatively high and action unlikely. However, the 'policy window' hypothesis supposes a number of adaptation drivers emerge to make reactive adaptation more likely, including new awareness of the risks posed by extreme climate events, the emergence or uncovering of problems with prevailing policies and governance arrangements, weakening of vested interests and enhanced political will to tackle the long-term impacts of climate change.

The adaptation drivers that work to facilitate action may encourage policymakers to overlook and underestimate important costs such as research, design and consultation with key stakeholders. Failure to properly account for and manage the costs involved in the design of an adaptation policy program can lead to significant decision failures and implementation failures such as negative externalities and poorly designed or inappropriate measures. Such outcomes will involve additional actual and opportunity costs associated with resolving conflict and implementation delays. For these reasons, the decision to adopt an adaptation policy program in response to policy windows arising from extreme climate events may lead to poor adaptation outcomes from a cost and efficiency perspective.

The second step employed in this thesis was to apply the explanatory framework to the case of the 2011 floods and the Thai Master Plan for Water Resources. Based on analysis of documentary evidence and public records, it appears likely that key costs were overlooked or underestimated resulting in substantial decision and implementation failures. Few resources were invested in designing the specific elements of the Plan or seeking feedback from stakeholders on the Plan's measures prior to or after the decision to adopt the Plan. Some key processes such as impact assessments and consideration of sensitive issues such as land reclamation were deferred until the implementation phase of the Plan and left to be managed by private contractors.

The government's poor management of decision-making processes was later reflected in substantial and costly decision failures. Key stakeholders who complained of being poorly consulted increasingly opposed the Plan, which led to significant implementation costs including legal action and delays. While very little of the Plan had been implemented when this research was undertaken, there is also evidence that the implementation failures resulting from implementation of the Plan could have been significant. It is likely that these costs would have grown had implementation of the Plan continued.

Despite the scale of the climate threat the Plan was designed to tackle, it is highly likely that much of it will be scrapped. In essence, the adaptation policy program that was designed by the Thai Government to respond to the 2011 floods will not be implemented. In the context of policy windows, the scrapping of the Plan will be a significant missed opportunity for the Thai Government to strengthen the country's capacity to adapt to and mitigate extreme climate events; particularly those resulting from flood. Given the significant resources that were invested in the design and preliminary implementation of the Plan, not to mention the potential avoided damage and loss associated with recent past and future flood events, failure to implement the Plan represents a significant mix of additional actual and opportunity costs and a poor outcome for climate change adaptation in Thailand.

In the final step described in this thesis, the findings were compared with insights from alterative theories of reactive policy development and governance. Comparing and contrasting the findings with work on policy change, scale and adaptive water governance it was confirmed that extreme climate events represent an important opportunity to advance adaptation policy due to the emergence of a unique set of adaptation drivers. Further analysis using these theories also suggested that due to the influence of these drivers certain costs associated with the adaptation cost trade-off will be overlooked or underestimated including institutional and technological 'lock-in' costs and decision-making costs such as consultation and planning. Applied to the Thai case these alternate theories suggested that the Plan's reliance on traditional hard infrastructure measures may have resulted in unforseen costs and that the high decision and implementation failures costs associated with the Plan were the consequences of the slight attention given to decision-making costs.

While the application of the explanatory framework in the Thai case was able to provide insights into why reactive adaptation in response to extreme climate events may result in poor adaptation outcomes, particularly from a cost and efficiency perspective, there are a number of limitations that should temper any conclusions regarding the broader relevance and applicability of the framework. Key issues include the framework's focus on negative adaptation outcomes, small sample bias associated with a case study approach and limitations associated with research methods relying on the analysis of secondary, documentary sources. These limitations could be addressed with further application of the framework to other cases and the use of empirical methods to quantify and compare costs and cases.

The value of the framework outlined in this thesis is that it provides a comprehensive overview of all of the actual and opportunity costs that policymakers should factor in their decisions regarding the whether or not to adopt an adaptation response to a given extreme climate event. It also highlights that regardless of the circumstances, action and inaction to

tackle climate change will involve costs. A conceptual understanding of the costs involved with reactive adaptation and how estimates of these costs can be influenced by the adaptation drivers that emerge from policy windows, will help policymakers avoid falling into the trap of believing that adaptation policy in response to extreme climate events is an inherently low-cost and naturally efficient course of action.

The framework and findings presented in this thesis, suggest that in response to extreme climate events policymakers should explore opportunities for adaptation, but proceed with caution. An important lesson to be taken away from this thesis is that the sense of consensus for decisive action in response to an extreme climate event should be resisted and not be used as a premise for reducing or avoiding important research and consultation processes necessary for policy development. Avoiding such processes is likely to lead to significant decision and implementation failures and poor adaptation outcomes. The presence of pre-emptive policy options in national adaptation plans may be able to reduce the likelihood that decision-making costs are neglected when pressure arises to take advantage of policy windows that open in response to an extreme climate events.

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