EXAMINING LOCAL JURISDICTIONS' CAPACITY AND COMMITMENT FOR HAZARD MITIGATION POLICIES AND STRATEGIES ALONG THE TEXAS COAST

A Dissertation

by

RAHMAWATI HUSEIN

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

May 2012

Major Subject: Urban and Regional Sciences

Examining Local Jurisdictions' Capacity and Commitment for Hazard Mitigation

Policies and Strategies along the Texas Coast

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ABSTRACT

Examining Local Jurisdictions' Capacity and Commitment For
Hazard Mitigation Policies and Strategies along the Texas
Coast. (May 2012)

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There have been studies on the role of land use planning and development regulations on hazard mitigation and the importance of including these in effective mitigation planning initiatives. However, little empirical research has examined how the local capacity and commitment affect the adoption and implementation of land use and development regulations to mitigate any type of hazards in the coastal areas. This study investigates hazard mitigation policies and practices at municipal and county level in the Texas coastal area and examines the influence of capacity and commitment for the adoption and implementation of these hazard mitigation strategies and actions.

The data utilized in this survey were collected as part of a web-based survey. Responses were solicited from 267 local jurisdictions that consist of 226 cities and 41 counties. The survey was targeted to leading planner, or mayor/city manager and county judges. In total 124 responses were obtained, yielding an overall response rate of 46%.

Study results show that local jurisdictions are employing a very limited a set of land use and development regulations that the literature has identified as important for hazard mitigation. There are considerable differences between municipalities and counties in the implementation of those policies. Municipalities tend to put more effort in employing building standards and development regulations, whereas counties more extensively employ information dissemination and private-public sector initiatives.

In addition, statistical models are developed to assess the influence of local capacity and commitment on the adoption and implementation of hazard mitigation policies and strategies. Other factors such as jurisdiction type and location, hazard experience and exposure as well as population characteristics, are also examined in multivariate models. Results suggest that capacity and commitment of local jurisdictions have significant effects on the adoption and implementation hazard mitigation policies and strategies. Additionally, factor such as floodplain area, jurisdiction type municipality, and hazard experience have strong associated with implementation of hazard mitigation policies and strategies.

DEDICATION

To my late father who had dreamed of studying abroad and to my mom who gave up her teaching profession to stay home raising her eight children.

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

Page

Page

Page

CHAPTER I

INTRODUCTION

1.1 Background

Over recent decades, coastal areas around the world have experienced coastal hazards such as tsunamis, hurricanes, tropical storms that caused the loss of human life as well as immense economic losses. The tsunami that hit Asia in 2004, for example, killed more than 200,000 people (Lay et al., 2005) and the recent earthquake followed by a tsunami that hit Japan on March 11, 2011 killed 15,839 people and has cost estimates up to $235 billion in damages, making it the most expensive natural disaster on record (Accuweather, 2011; The Economist, 2011). From 1970 to 2009, seven of the world's ten most costly disasters, in terms of insured losses, were coastal disasters, specifically hurricanes that struck the United States (Sigma, 2011). These storms are Katrina (2005), Andrew (1992), Ike (2008), Ivan (2004), Wilma (2005), Rita (2005), and Charley (2004). Together they totaled 2,232 killed and over 164 billion dollars in insured losses (Sigma, 2011).

This escalating loss and vulnerability in coastal areas is partly due to the increasing concentrations of population and infrastructure with high exposure to natural hazard (Crossett et al., 2004). Studies have shown that the rise in human habitation and structural development along coastlines contributed to the destruction of coastal

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resources such as wetlands and coastal forests that can lessen damage to property and reduce loss of life (Forbes & Broadhead, 2007; Williams & Micallef, 2009).

In the US, 53% of the nation's total population currently lives in coastal counties and the coastal population has grown by more than 33 million since 1980. It is expected to reach 165 million by 2015 (Wood & Poole and NOAA, 2010). The National Oceanic and Atmospheric Administration (NOAA) also reported that more than 60 percent of homes and buildings within 500 feet of the shoreline are located along the Atlantic and Gulf coasts, the nation's fastest growing areas (The National Academies, 2011). As a state that has one of the longest coastal lines, Texas is not exempt from the trend. The recent census shows that the Texas coastal population has grown 21% since the previous census (US Census, 2011). The census also indicates that the Texas coast is one of the fastest growing coastal regions in the country. It is home to one of the US' ten largest metropolitan areas to be located in a coastal zone – the greater Houston area (Peacock, 2008; Wilson, 2009), where the population of the Houston-Baytown-Sugarland metropolitan area increased 21.5% from 2000-2008 (THMP, 2010).

The increasing population in coastal areas intensifies people's hazard vulnerability and adds to a risk of property loss. Throughout history, Texas has been one of the states that has experienced great damage due to multiple hazards in the coastal region. The Texas coast not only suffers from recurring hazards of high probability such as hurricanes, wind storms, and flooding, but also hazards of lower probability such as subsidence, sea level rise, and coastal erosion. According to NOAA, since 1950, 26 hurricanes and 32 tropical storms have passed within 75 miles of the Texas coast line

(Wilson, 2009). The annualized physical losses from hurricanes and tropical storms alone faced by the State and local government from 2005-2010 are $ 6.1 million, around $4.7 million of which is borne by local government and it is estimated to reach $1.4 million at the state level (THMP, 2010). These numbers do not include Rita and Ike damages nor riverine flooding damages resulting from these hurricanes. For hurricane Ike only, which was one of the costliest and most destructive hurricanes in U.S. history, the total damage is estimated to be $27,8 billion (adjusted to 2010 dollars), making it the third costliest hurricane behind Katrina and Andrew (Blake & Gibney, 2011). In addition to hurricane and tropical storm exposure, the Texas coast has experienced the highest coastal erosion in the nation, where approximately 64% of the Gulf shoreline is considered a critical erosion area with 235 acres of shoreline lost to erosion annually (THMP, 2010). Such erosion affects property and the natural environment.

These escalating losses and increasing vulnerability in the coastal region should influence local governments to adopt policies that can reduce the risk and increase the calls for mitigation as part of the solution (Peacock et.al, 2009). Regardless of what jurisdictions should be doing, there has been a clear movement toward more mitigation planning. The trends toward mitigation planning have been driven by the Federal Emergency Management Agency (FEMA), which launched the Disaster Mitigation Act in 2000 (DMA 2000). The aim of this act is to reduce the loss of life and property, economic disruption, human suffering, and disaster-assistance costs from natural hazards (FEMA, 2011). This Federal legislation requires state, local, and Indian tribal governments to develop hazard mitigation plans in order to receive post-disaster assistance. So far, over 10,000 local jurisdictions have participated in local mitigation plans, where 1,696 out of the 3,141 counties in the nation took part in the planning process (FEMA, 2011). Texas has also participated in creating local hazard mitigation plans. Since the end of 2003, there have been 16 city plans, 33 county plans (which cover cities and unincorporated areas), 10 regional plans (which cover counties, cities, and unincorporated areas), and 9 other plans, including schools and hospitals, all of which received FEMA-approval (TXDPS, 2011).

Yet, the increasing number of local jurisdictions that participated in local hazard mitigation planning activities has not guaranteed the implementation of mitigation strategies at the local level. For example, a study of Local Mitigation Strategy (LMS) in Florida, a pilot program for planning requirements and planning mandates in response to DMA 2000, found that local mitigation plans are not actually a step toward creating mitigation actions, but rather are a bureaucratic step in the mitigation grant funding process and "did not reduce disaster loss" (Rovins, 2009, p.19).

One of the reasons that local mitigation plans do not work successfully is that in many cases, local mitigation plans are not incorporated into or sufficiently linked to, city or county comprehensive plans, master plans, and/or other land use plans. In other words, these plans end up being free standing plans and have little bearing on, among other things, modifying land use policy to bring about reduce vulnerabilities. This disconnection may result in a weakening of the potential of a plan's effectiveness (Burby, 1998). In addition, local hazard mitigation plans are often under the direction of and undertaken by local emergency managers without involvement of planning departments. Schwab (2010) notes from Boswell studies on Local Hazard Mitigation Plan (LHMP) prepared in California who found that 50% of LHMP were prepared by emergency managers, 29% by consultants, and 21% by both emergency managers and consultants. This hazard planning process may not include planners in formulating the local hazard mitigation plan and often lacks an understanding of land use and development regulations and their potential importance for mitigation. In other words, while local hazard mitigation plans may offer potential "actions" to be undertaken should mitigation funding become available, they fail to include inform local land use planning strategies and efforts that might be accomplished with proper integration into comprehensive planning efforts.

Thus far, several studies have shown that land use tools and development regulations can be effectively used for hazard mitigation, particularly if they are backed by state planning mandates (Berke & French, 1994; Berke et.al., 1996; Burby & Dalton, 1994; Burby & May, 1997; Godschalk, et al., 1999). However, most of these studies have focused on the quality of plans and whether stand-alone mitigation plans or elements of comprehensive plans address mitigation issues. It was relatively rare to find research that actually focused on the types of land use policies adopted and implemented by local jurisdictions. Whether focusing on plans or policy implementation, many of these studies focused on the role of capacity and commitment in adopting land use and development regulations (Brody, Kang, & Bernhardt, 2010; Burby & May, 1998; May, 1993; Tang, 2008; Tang, Lindell, Prater, & Brody, 2008). When addressing the effects of capacity and commitment, studies have generally employed a host of different types of measures to loosely capture dimensions of capacity and commitment in adopting land use and development regulation. Rarely has there been a concerted effort to capture the theoretical concepts of capacity and commitment. Furthermore, many of these studies focused on hazard mitigation with respect to a single hazard such as flooding (Brody et al., 2010), tsunamis (Tang, Lindell, Prater, Wei, & Hussey, 2011), or hurricanes (Wilson, 2009). Very few studies look at multiple hazards in coastal areas. Lastly, extant studies have mostly focused on state and/or county government actions with respect to hazard mitigation polices and planning. Specifically, they are often limited in the nature of the jurisdictions considered, focusing on state and county levels, but neglecting policies and planning at the municipality level. In many states, however, the state and county have only limited possibilities for engaging on land use planning activities and policies, while municipalities have more authority in regulating land use and controlling development.

These neglected areas in the research lead to questions about the actual prevalence of local governments' employment of land use and development regulations that have the capability to enhance hazard mitigation in coastal areas. In other words, there are a host of broad-based land use policies ranging from education programs through newer incentive-based zoning policies and ordnances that can be used to address hazard mitigation, yet little is known about the prevalence of these tools and extent to which they are employed. Second, given the focus on states or plans themselves, there is relatively little that is known about the factors that shape the adoption and usage of these regulations within coastal jurisdictions. This research seeks to addresses these short comings by looking into current coastal hazard mitigation practices with respect to land use planning and development regulations and exploring the roles that local capacity and commitment, which may influence how local governments carry out the hazard mitigation policies, play in determining the extent to which these policies are employed.

1.2 Specific research objectives

The overall objective of this study is to empirically investigate policy practices at the local level. The study specifically seeks to

1. Examine the adoption and the implementation of land use and development regulations and practices that can enhance hazard mitigation within local jurisdictions (counties and municipalities) in the Texas coastal zone;
2. Explore the use of key indicators of institutional capacity and commitment for measuring these concepts;
3. Examine the influence of local capacity and commitment in the adoption and extensiveness of land use and development regulations and practices that can enhance hazard mitigation; and
4. Examine whether other factors such as hazard experience, location, jurisdiction type, and population characteristics influence the adoption and of land use and development regulations and practices that can enhance hazard mitigation.

1.3 Significance or justification

This research is significant and can be justified by three different points of view. First, it addresses the current need in the field of hazard and disaster research to assess the prevalence and extent of usage of different land use and development policies among jurisdictions in Texas coastal areas. This is important in regard to planning traditions since Texas is highly vulnerable to coastal hazards, yet planning is not mandatory, thus local jurisdiction land use planning may be absent (Beatley, 2009; Burby, 2003; Burby, 2006).

Second, this research will seek to provide useful approaches for measuring capacity and commitment at the local level based on the literature and empirical approaches. It was mentioned earlier that there are a variety of indicators suggested by the literature to be important for measuring capacity and commitment. This study will examine a set of indicators for capacity and commitment. Lastly, this study may also provide insights for State and Federal policy into factors related to the development of organizational capacity and strengthening of institutional commitment at the local government level for addressing land use and development regulations aimed at enhancing coastal hazard mitigation.

1.4 Structure of the dissertation

This dissertation is organized into seven chapters. Chapter I provides the background and objectives of the research. Following this introduction, Chapter II provides a literature review which builds a theoretical foundation for this study. It reviews the literature about hazard mitigation through land use in the coastal areas as well as discusses definitions and elements of local capacity and commitment. Chapter III presents the research design and methods. Chapter IV describes in detail the hazard mitigation policies and tools that are employed by local jurisdictions in Texas coastal areas. Chapter V develops a conceptual framework which will discuss i) hazard mitigation policies and strategies, ii) the indicators or characteristics of local capacity and commitment, and iii) other factors that influence the adoption of policies, as well as discuss the measurement and hypothesis. Chapter VI discusses factors influencing the extent to which hazard mitigation policies and strategies are employed. Chapter VII presents a general discussion of the results, conclusions, limitations of the study, and recommendations for future research.

CHAPTER II

LITERATURE REVIEW

This literature review provides a theoretical foundation for developing the conceptual model of factors that are suggested to influence the adoption and implementation of various land use and development policies that can be employed to enhance the a jurisdiction's mitigation status. A focus will be factors suggested by the literature to be key: capacity and commitment. Indeed, final sections of this chapter will be devoted to providing a theoretical framework for measuring these key concepts employed in the analysis of the adoption and implementation of land use and development regulations for hazard mitigation.

The following discussion will begin with the concepts of natural hazards and coastal hazards, hazard mitigation definition, and constraints and strategies for mitigation. The critical focus of this chapter however is a discussion of the type of non-structural hazard mitigation policies and strategies have been proposed and adopted by local jurisdictions – the focus of this dissertation. The final section will address factors suggested by the literature to influence local jurisdictions' adoption and usage of hazard mitigation policies and strategies. A critical focus in this discussion will be on two key factors -- capacity and commitment – that are often identified by the literature as being of paramount importance when distinguishing between jurisdictions that address or fail to address hazard mitigation issues. The discussion begins with the nature of coastal hazards.

2.1 Natural hazards and coastal hazards

This section will discuss natural hazards and the types of hazards often associated with coastal areas. A natural hazard is a threat of a naturally occurring event that can have negative effects on people and/or the built and natural environments (Hyndman & Hyndman, 2006; Klee 2009; Lindell, Prater, & Perry, 2006). Alexander (2000) defines a natural hazard as an extreme event that originates in the biosphere, lithosphere, hydrosphere, or atmosphere to differentiate them from technological hazards such as explosions, releases of toxic materials, severe contamination, structural collapses, and social hazards such as crowd crushes, riots, and terrorist incidents. A natural hazard can become a natural disaster when an extreme event exceeds a community's ability to cope with that event or to co-exist with powerful natural processes (Lindell et al., 2006).

The word "natural" remains problematic as some people believe that natural conveys a condition that is a given and can be solved. Although the magnitude, time, and size may not be precisely calculated, some believe that a natural hazard actually can be predicted, not as isolated and independent events, particularly when a hazard refers to the interaction between humans and their environment (Alexander, 1993). There is an emerging consensus in the scientific community that natural disasters are not in fact wholly "natural" events. Natural disasters are outcomes of the interaction between biophysical systems, human systems, and their built environment (Lindell et al., 2006; Peacock et al., 2009). Mileti (1999, p.2), for example, describes a disaster as a result of the interaction of physical environments, which include extreme events, the social demographics of the communities that experience them, and the buildings, roads, bridges, and other components that constructed an environment. The losses are increasing and becoming complex, in part because of the contribution of humans in their failure to appropriately locate, plan and design their communities (Mileti, 1999; Peacock et al., 2009; Schwab, 2010).

This interaction can occur in any type of geographic location, including coastal areas, which are exposed to various hazardous events. The biophysical hazard events that take place in the coastal area are often defined as coastal hazards (Beatley, 2009). In addition, Klee (1999) states that the coastal hazard zone "extends inland from the shorelines which are likely to be affected by or vulnerable to any type natural event" (p. 2). Table 2.1 illustrates the many types of coastal hazards often addressed in the literature (Beatley, 2009; Klee, 1999).

Thus, in Texas coastal areas, the natural events that mostly occur in are meteorological events including hurricanes, tornadoes, and droughts (THMP, 2010), which may be associated with hazards such as storm surges, high winds, heavy rain, flooding, coastal erosion, and droughts.

Table 2.1 Coastal natural hazards

Category	**Event**	**Hazards**
Meteorological	Nor'easter*	Storm surges, high winds, heavy rain, flooding, possible heavy snow, coastal erosion
	Blizzards*	Snow and freezing conditions, low visibility, damage to infrastructure, high winds
	Ice storms*	Freezing conditions, damage to infrastructure, severe transportation disruption
	Hurricanes**, tropical cyclones*	Storm surges, high winds, possibility of tornadoes, heavy rain, flooding, coastal erosion
	Tornadoes, typhoons	Extremely high winds, heavy rains, possible hail
	Drought and heat waves	Extreme temperatures, loss of crops, possible infrastructure damage
	Long waves and short waves (Tidal waves)	Storm surges, high winds, heavy rain, flooding, coastal erosion
	Lightning	Electrical discharge, possibility of wildfires
	Hail	Often accompanies tornadoes, possibility of acute and extensive property damage
Geological	Earthquakes**	Shaking terrain, possible ground rupture, landslide, land subsidence, destruction of homes and infrastructure
	Landslides and mudflows**	Possibility of rock falls, land subsidence, tsunamis, ground cracking
	Volcanoes**	Lava flows, volcanic gases, and aerosol, ground cracking, landslides, tsunami
	Tsunamis**	Massive storm surges, flooding, high potential for loss property and life
Hydrological	Floods	Erosion, landslides, increase in water levels, groundwater pollution
	El Nino, La Nina	Drought, flooding, frost, landslides, erratic temperatures and weather
	Wildfire	Result of natural and criminal causes and/or negligence; high possibility for great ecological, human, and property loss

Source: (Beatley, 2009, and Klee1999); * generally occurring on the U.S. east coast; ** generally occurring on U.S. Pacific Coast.

2.2 The role of government in disaster mitigation: from reactive to proactive

Since Roman times, public safety has been a primary responsibility of governments, as illustrated in the Latin phrase "*salus populi suprema lex esto*, or *the* *welfare (safety) of the people is the supreme law"* (Henstra & McBean, 2004). Although many citizens may believe that government has a basic responsibility to maintain and restore public safety, there is always an interesting question and debate about why natural disasters are perceived to be *public* problems (Schneider, 1995), how far the intervention should extend, and what is the appropriate role of government with respect to the phases of disasters (preparation, response, recovery, and mitigation). These questions remain debatable particularly when addressing mitigation – should government's role be limited or should mitigation perhaps be totally under the purview of the private sector (Henstra & McBean, 2004; Schneider, 1995)?

Henstra & McBean (2004) argue that government in general may act as a protector, in that it has an obligation to take appropriate actions in the public's interest to reduce the risk of injury or property damage, to lessen the economic disruption when events occur, and to help particularly when people are unwilling or unable to protect themselves from the hazards in their environment. In the US, the federal government has developed some guidelines for official activity before, during, and after disasters occur (Schneider, 1995). Traditionally, the federal government has addressed disasters or their potential by providing warning before disasters strike, emergency relief after a disaster occurs, and hazard reduction measures, particularly structural mitigation measures such as levees and dams, to reduce the likelihood of future disasters (Burby, 1998).

However, those activities have proven to be inadequate and do not provide adequate response time as there are often too few people heeding warnings, a general lack of preparation, and relatively weak planning and coordination of services during the relief and recovery processes. In addition, emergency relief and response can be costly, particularly for local governments, and are all too often ineffective for repetitive hazards like hurricanes, tornadoes, and flooding. Therefore, preemptive strategies in the form of mitigation have become more important for addressing any type of natural hazard occurrence.

The emphasis in reducing losses through mitigation strategies has been growing through time, although there have been some setbacks post 9/11. This trend is reflected on a variety of fronts. First, the ongoing shift in the disaster field has been from post-event relief to pre-disaster preparedness, planning, and mitigation (Schwab, et al., 2007; Schneider, 1995). In the US, natural mitigation policy at the federal level was begun with the Robert T. Stafford Disaster Relief and Emergency Assistance Act of 1988 and its accompanying regulation in Title 44 of the Code of Federal Regulation part 206 (44 C.F.R.206) (Godschalk et al., 1999; Lindell et al.,2006; Scwab et al., 2007). Under this act, pre-disaster hazard mitigation plans were detailed. It is mentioned in *Title II: Disaster Preparedness and Mitigation Assistance,* that the federal government can establish a program to provide financial assistance to states through the National Pre-disaster Mitigation Fund. States can use the funds to develop mitigation plans that can lessen the impact of disaster on the public health, infrastructure, and economy of the community (FEMA 592, Robert T. Stafford Disaster Relief and Emergency Assistance Act as amended and related authorities, June 2007).

In addition to the Stafford Act, the creation of a Mitigation Directorate in FEMA during 1993 significantly raised the level of attention given to hazard mitigation and helped in implementing mitigation strategies by coordinating hazard mitigation efforts (Lindell et al., 2006). Some of the main strategies of the directorate are managing the National Flood Insurance Program (NFIP) and a range of programs designed to reduce future losses to home business, schools, public buildings and critical facilities from natural hazard (FEMA, 2008a; FEMA, 2008b). Some of its activities are to encourage communities to do the following:

1. Complying with or exceeding NFIP floodplain management regulations;
2. Enforcing stringent building codes, flood-proofing requirements, seismic design standards, and wind-bracing requirements for new construction or repairing existing buildings;
3. Adopting zoning ordinances that steer development away from areas subject to flooding, storm surge, or coastal erosion;
4. Retrofitting public buildings to withstand hurricane-strength winds or ground shaking;
5. Acquiring damaged homes or businesses in flood-prone areas, relocating the structures, and returning the property to open space, wetlands, or recreational uses; and
6. Building community shelters and tornado safe rooms to help protect people in their homes, public buildings, and schools in hurricane- and tornado-prone areas.

The promotion of hazard mitigation policies became even stronger when the DMA 2000 was signed to amend the Stafford Act. The legislation is aimed primarily at controlling and streamlining the administration of federal disaster relief and mitigation programs, emphasizing pre-disaster mitigation planning to reduce disaster losses (Schwab et al., 2007). In addition, Section 322 of the DMA specifically addresses mitigation planning at the state and local level. The key element of DMA 2000 was the requirement for state and local governments to develop hazard mitigation plans. Each state and local government must have an approved Local Hazard Mitigation Plan in order to receive disaster assistance. FEMA provides guidelines and resources to facilitate the mitigation planning process.

Despite these changing trends and newer programs and requirements, mitigation is generally a low priority for local governments and individuals for many reasons. First, because the benefits of mitigation activities are not immediately tangible and can be difficult to evaluate, the costs and sacrifices that are often required to reduce personal and community vulnerability are difficult to justify in the absence of an imminent threat (Col, 2007; Hyndman & Hyndman, 2006). Second, mitigation policies often raise fundamental socioeconomic issues such as livelihood safety and resource distribution equity, which governments are reluctant to tackle (Bendimerad, 2003). Third, it takes long time to see the results of realized policies, so elected officials who want to show visible results to their constituents might hesitate to choose those policies (Berke & French, 1994). Fourth, based on a libertarian perspective, individuals have autonomy and posses the ability to determine for themselves what they need to do. This perspective would imply a minimal role for government in location decisions or housing preferences through policies such as zoning laws, building code requirements, or mandatory insurance (Trebilcock & Daniels 2006, p. 90). In line with this, Hynmand & Hynmand (2006) suggest that people are reluctant to apply and enact mitigation strategies because any attempt of government to employ land use restriction will infringe on individual property rights. Despite these challenges, there has been a general trend toward more local jurisdictions adopting some form of mitigation planning, for as FEMA (2010) policy suggests, mitigation planning can form the foundation for a community's long-term strategy to reduce disaster losses and break the cycle of disaster damage, reconstruction, and repeated damage. The mitigation policies and strategies, particularly for reducing the impact of coastal hazards, will be discussed in the next section.

2.3 Hazard mitigation policies and strategies in the coastal areas

As discussed earlier, hazard mitigation is a critical part in the disaster management cycle and focuses on undertaking preventive actions to reduce future losses. Figure 2.1 displays the disaster life cycle described by FEMA. The process consists of "preparing for emergencies and disasters, responding when the event occurs, helping people and institutions recover from the event, mitigating the effects, reducing the risk of loss, and preventing disasters such as fires from occurring" (FEMA, 2011). Mitigation in this cycle is important as it covers risk reduction and prevention, which when combined yields benefits to society. For instance, mitigation creates safer communities by reducing loss of life and property, decreasing the time it takes to rebuild and recover after a disaster, and decreasing the financial impact on the Federal Treasury, states, tribes, and communities (FEMA, 2011).

As with so many concepts, hazard mitigation has been defined in a variety of ways in the literature. The term of mitigation mostly reflects protection, reducing or eliminating impacts, and action before the event. Table 2.2 displays a variety of different definitions for the concept and as a consequence also illustrates that the definitions of hazard mitigation are considerably diverse, reflecting the complex nature of the ideas many associate with the concept. Some consider mitigation to include activities for emergency preparedness and response and recovery planning such as preparing personnel, plans, facilities, equipment, and materials needed during the event and after the event (FEMA, 2011; Godschalk et al., 1999). Others focus on long-term action or activities that are passively in place prior to an event (Lindell et al., 2006). This latter approach is rather distinctive and yet has the strong advantage of clearly differentiating mitigation from other phases in the disaster cycle - a distinction often lacking in other approaches.

Source: www.fema.org/about

Figure 2.1 FEMA cycle of disaster management

Table 2.2 Selected definitions of hazard mitigation published in the hazard and environmental literature

Researchers/ Institution	**Definitions of hazard mitigation**
FEMA (2007)	Hazard mitigation is sustained action taken to reduce or eliminate long-term risk to people and their property from hazards.
Lindell, Prater & Perry (2006)	Mitigation is pre-impact actions that provide *passive* protection at the time of disaster impact. It distinguishes hazard mitigation from emergency preparedness, which consists of pre-impact actions that provide the resources (personnel, plans, facilities, equipment, materials) needed to support an *active* response at the time of disaster impact.
Godschalk, Beatley, Berke, Brower & Kaiser (1999)	Hazard mitigation is advance action taken to reduce or eliminate risk to human life and property from natural hazards in the long run.
William & Micalef (2009)	Cost-effective measures taken to reduce potential for damage to a community from hazard impacts.
Moga (2002)	Mitigation planning or disaster reduction is the development of a strategy for reducing the impact of disasters on a community, facility, agency, city or country.
UNISDR (2002)	Hazard mitigation is structural and non-structural measures undertaken to limit the adverse impact of natural hazards, environmental degradation and technological hazards.
Scwab, Eschelbach, & Brower (2007)	Mitigation is defined as activities that prevent a disaster, reduce the chance of a disaster happening, or lessen the damage effect of unavoidable disasters and emergencies.

Despite these variations there is a good deal in common among these definitions. Common aspects include the ideas that mitigation actions are mostly focused on activities prior to a disaster, these actions (or more precisely their results/products) provide passive reduction of disaster.

The occurrence of most hazards is impossible to predict with a high degree of precision, but experts have estimated the probabilities that different types of events will occur within a given time interval (e.g., a 50 percent chance of a major earthquake within the next 30 years), and much of the impact can be prevented or substantially reduced by undertaking activities prior to hazard events (Godschalk et al., 1999). In addition, others believe that hazards can be prevented and their impacts can be reduced based on how we design or plan our communities (Mileti, 1999; Peacock et al.,2009) in order to reach the goal of mitigation giving "passive protection" at the time of disaster impact (Lindell et al., 2006).

Mitigation strategies have commonly been classified into structural and non-structural mitigation (Godschalk et al., 1999; Lindell et al., 2006). Structural mitigation involves the use of engineered safety features to provide protection from disaster impacts (Lindell et al., 2006, p. 194). The most common examples of structural mitigation include levees, dams, seawalls, dykes, and riprap (Godschalk et al., 1999; Klee1999; Lindell et al., 2006), and also "building designs and constructions materials to increase the ability of an individual structure's foundation and load bearing framework to resist environmental extremes" (Lindell et al., 2006, p. 194).

Meanwhile, non-structural mitigation involves a broad set of mitigation strategies that include regulating development in environmentally sensitive areas, installing window shutters for buildings located on hurricane-prone coastlines, and educating the public to reduce any impact of hazards (Burby, 1998; Godschalk et al., 1999; Lindell et al., 2006). Table 2.3 shows a broad list of strategies for both structural and non-structural categories of hazard mitigation for coastal areas.

Table 2.3 Structural and non-structural hazard mitigation strategies for coastal areas

	Structural	**Non-structural**
Concept	- Control over hazard - Protection of human settlement	- Hazard mitigation/ avoidance - Adjustment of human activities
Measures	- Sea walls, levees, structure of dams, break water, flood storage reservoirs, dikes, pumps, channel improvements and diversions, and groins - Strengthening buildings through building codes - Building shelters	- Land use management by planning tools (comprehensive plan, zoning, ordinance, incentives) - Infrastructure policy - Insurance - Awareness (education, information dissemination) and partnership - Protect natural areas (dunes, wetland, maritime forests, vegetation etc.) - Risk reduction and preparedness policies

Sources: adapted from Burby & French (1981); Alexander (1993); Moga (2002); William & Micalef (2009)

However, it should also be noted that many scholars have pointed out that structural strategies that involve modifications of the natural and physical environment may cause physical damage and degradation of the natural environment. Examples of these problematic outcomes include the destruction of wetlands despite the mitigation services they can provide in coastal regions as well as increasing the likelihood of human-made disasters resulting from the failure of dams and levees (Klee, 1999) and discouraging the protection of natural resources (Dalton & Burby, 1994). In the case of Hurricane Katrina, large areas of the city of New Orleans were destroyed because of the failures and breaches of the levees and floodwalls protecting the city due to poor maintenance and design failure (Daniels, Kettl & Kunreuther, 2006). In addition, structural mitigations are very expensive and require enormous ongoing costs for their maintenance (Alexander, 1993; Burby, 1998), and failure to maintain them can lead to great losses. Furthermore, structural approaches may provide a false sense of security to the public (Burby & Dalton, 1994; White, 1936). The belief that coastal areas are protected and made safe by seawalls, levees, dykes, and others structural works can encourage new development in the hazardous or environmentally sensitive areas (Burby & Dalton, 1994).

On the other hand, non-structural approaches have been seen by many in the literature as offering a more comprehensive approach that results in fewer negative effects, at least with respect to promoting appropriate development in risky areas and with respect to the natural environment. Non-structural approaches are also relatively less costly and provide more sustainable tools to hazard mitigation at the local level. They offer a more obvious way to avoid many natural catastrophes (Hyndman & Hyndman, 2006) and provide important tools for reducing losses to natural disasters (Burby et al., 2000). Numerous research studies on hazard mitigation using non-structural strategies in the US as well as in other countries have been conducted (Berke et al., 2006; Burby et al., 1985; Burby, et al., 1999; Godschalk, Brower, & Beatley, 1989; Henstra & McBean, 2004). Conceptually, this strategy focuses on adjusting human activities, particularly developmental activities, by encouraging development out of harm's way, appropriate development that explicitly addresses the natural hazard exposure, risks associated with an area, and the preservation of environmental resources, particularly those in sensitive areas, and thereby enhancing the natural environmental services that can reduce natural hazard impact.

2.4 Non-structural mitigation strategies

While the distinction between structural and non-structural hazard mitigation strategies presented in Table 2.3 offers some clarification of the types of policies and land use strategies generally considered non-structural, they fail to provide a full discussion of the types that will be considered in this dissertation. The literature offers a host of ways to classify non-structural strategies (Beatley 2002; Daniels & Daniels, 2003; Godschalk et al., 1999; Lindell, et al., 2006). Table 2.4 provides a classification of various types of strategies, along with their goals and detailed examples of the strategy tools that fall under these categories based on the literature.[1] In total, 11 strategies are identified: 1) development regulations and land use management tools, 2) limiting shoreline development, 3) building standards, 4) natural resource protection, 5) public information and awareness tools, 6) incentive tools, 7) property acquisition tools, 8) financial tools, 9) public and private facilities policies, 10) private-public sector initiatives, and 11) use of professionals. Since these non-structural hazard mitigation techniques are the focus of this dissertation, the following offers a more complete discussion of them.

[1] The exact placement of a particular tool, such as hazard setbacks, is somewhat arbitrary, because policies are often related and tools can be employed in a variety ways. Hence, the focus of this table is not to definitively categorize tools, but rather provide a convenient method for identifying different strategies and tools.

Table 2.4 Land use and development regulations for hazard mitigation in coastal areas

Strategy	Goals	Tools
Development regulation and land use management	- Restrict occupancy in hazardous zones (location) - Density regulation - Discourage development in environmentally sensitive/hazardous areas	- Residential subdivision ordinance - Planned unit development - Special overlay districts - Agricultural or open space zoning - Performance based zoning - Hazard setback ordinance - Storm water retention requirements
Limiting shoreline development	- Limit use of shoreline - Restrict activities in environmentally sensitive/hazardous areas	- Limitation of shoreline development to water-dependent uses - Restrictions on shoreline armoring - Restrictions on dredging/filling
Natural resource protection	- Preserve ecologically sensitive coastal areas	- Dune protection - Wetland protection - Coastal vegetation protection - Habitat protection/restoration - Protected areas
Building standards	- Design regulation (type and category) that reduce loss and damage	- Building codes - Wind hazard resistance standards - Flood hazard resistance for new homes - Retrofit for existing buildings - Special utility codes
Public information and awareness	- Disseminate information and advise individuals, groups, as well the community in general about hazards, hazardous areas, and mitigation techniques and goals	- Public education for hazard mitigation - Citizen involvement in hazard mitigation planning - Seminars or workshops on hazard mitigation practices for developers and builders - Hazard disclosure - Hazard zone signs
Incentive tools for environmentally sensitive/hazardous area	- Encourage land owners to avoid development in hazardous areas - Risk dispersion and risk reduction	- Transfer of development rights - Density bonuses - Clustered development - Participation in the National Flood Insurance Program (NFIP) - Participation in the FEMA Community Rating System (CRS)
Financial tools	- Distribute more fairly the public costs of private development	- Lower tax rates - Special tax assessments - Impact fees or special assessments

Table 2.4 Continued

Strategy	Goals	Tools
Property acquisition programs	- Acquire and hold property for public benefit and use - Remove at-risk property from the private market	- Fees for simple purchases of undeveloped lands - Acquisition of developments and easements - Relocation of existing structures out of hazardous areas
Critical public and private facilities policies	- Direct the location of infrastructure away from hazardous areas	- Requirements for locating public facilities and infrastructure - Requirements for locating critical private facilities and infrastructure - Using municipal service areas to limit development
Private-public sector initiatives	- Work with other private entities to mitigate hazard impacts	- Land trusts - Public-private partnerships
Use of Professionals	- Reducing hazard impact through building mitigation	- Identify suitable building sites - Develop special building techniques - Conduct windstorm/roof inspection

2.4.1 Development regulations and land use management

Development regulations and land use management are significant tools for hazard mitigation policies' adoption in the coastal region. The concept of integrating hazard mitigation with development regulation and land use management at the local level has a long history. Gilbert White and other scholars (Burby et al., 1993; Burby, et al., 1999; Godschalk, et al., 1989) have argued that the loss of lives and property from a range of natural hazards could be minimized through land use planning. In addition, studies also show that land use and development-management mandates can positively impact mitigation by steering development away from hazard areas (Burby, 1998;

Godschalk, et al., 1999; May, 1993). Zoning and subdivision ordinances are basic and still are the most frequently used tools (Burby, 1998; Deyle et al., 1998), and are considered traditional approach to planning (Olshansky & Kartez, 1998).

Many researchers agree that these strategies can be implemented by local governments as they generally have the regulatory power to implement these tools that can direct development (Godschalk et al., 1999; Schwab et al., 2006). Local jurisdictions may use these regulatory tools to keep population and development away from high-risk locations and impose performance standards to reduce vulnerability in exposed areas. For instance, by requiring new development to be set back a minimum distance from high erosion shorelines, structures are not only kept out of harm's way, but natural environmental features like dunes and mangroves can be better preserved (Beatley, 2009, p. 30). In addition, Tang (2009) states that development regulations have been widely used in coastal zone management since they can provide the most direct approach of land use management aiming to protecting critical coastal environments and coastal disaster-vulnerable areas.

2.4.2 Limit development and activities on shoreline

Structural approaches to mitigation such as armoring and dredging have been used for a long time to reduce or eliminate erosion of natural shorelines and protect the built environment. However, these strategies can radically alter the characteristics of natural habitats and may influence and adversely impact the natural environment for some distance surrounding the structure. It can cause a) excessive erosion on neighboring unarmored properties; b) an increase water depth by transporting near-shore sediment to deeper water, producing "wave bashing" effects and turbulence; (c) a decrease in habitat complexity; and (d) an increase in habitat for predators such as bass and sculpin (Sargeant et al., 2004; The Watershed Company, 2008). In addition, shoreline "water-dependent uses are threatened with displacement or have given way to more profitable non-water-dependent uses, such as residential, hotels, retail shops and restaurants" (Walker & Arnn, 1998, p. 2).

Therefore, limiting development to preserve water-dependent uses and restricting activities on the shoreline may help encourage the natural preservation and restoration of the natural environment -such as dune and coastal vegetation- which can mitigate coastal hazards in a more sustainable way. Bernd-Cohen and Gordon's (1999) study of Coastal Zone Management (CZM) programs shows that the use of regulatory tools along the shoreline can lessen shoreline change and reduce development pressures in order to protect the shoreline from hazards and minimize adverse impacts on resources. Examples of the types of actions local governments may implement to restrict extreme physical changes might include the limitation of shoreline development to water-dependent uses, restrictions on shoreline armoring, and restriction on dredging/filling.

2.4.3 Natural resource preservation and protection for coastal hazard mitigation

Many scholars have discussed the idea of preserving and protecting natural resources for coastal hazard mitigation (Beatley et al, 2002; Beatley, 2009; Brody, Highfield, & Kang, 2011; Daniels & Daniels, 2003). The fact that coastal areas are subject to excessive growth not only results in the settlement of hazardous areas but also the destruction of local ecosystems which could have provided protection from natural peril (Mileti, 1999). In addition, the loss of natural barriers such as wetlands, barrier islands, estuaries, water supply reservoir buffers, dunes, and forests has been linked to an increased risk of many types of hazards such as flooding, hurricanes, storm surges, and coastal erosion (Beatley, 2009; Bernd-Cohen &Gordon, 1999; Klee, 1999; William & Micalef, 2009).

Some researchers suggest mitigation strategies that maintain protective features of natural environments and focus on ecosystem management, such as the use of vegetation for reducing wave action, current energy, and erosion as well as trapping sediments that are urgently needed (William & Micalef, 2009). They also suggest other examples including enhancing coral reefs, preserving and enhancing dune formation and sand bars, planting forests (porous barriers), preserving wetlands and mangroves, and hybrid strategies that are also relatively effective as mitigation tools (William & Micalef, 2009). Meanwhile, Beatley (2009) suggests that coastal communities need to ensure sufficient wetland buffers and must permit coastal wetlands to migrate landward in response to long-term sea level rise. Many of these strategies have been instituted by the Coastal Zone Management Act (CZMA) of 1972 which requires that states designate "areas of particular concern," and the 1980 amendments to CZMA, which encouraged "special area management planning." This act and its amendments provide the legal foundation and funds for local governments in coastal regions to improve policy and practices in improving the natural resources of their coastal areas and reducing any impact of natural hazards. Examples of the types of policies local governments might address include wetland protection, habitat protection and restoration, and simply protecting and perhaps even expanding preservation areas (Beatley et al., 2002; Daniels & Daniels, 2003).

2.4.4 Building standards

Implementing building standards and codes that minimize the loss of and damage to buildings from natural hazards can be a crucial strategy for hazard mitigation in coastal areas. These strategies are particularly needed because local governments often display little or no ability to limit development in high-hazard coastal regions. The inability to control development is a function of many factors such as the attachment of residents to their lands, land development rights, limited choices that can result in purchasing property in the environmentally sensitive areas that are the most affordable for people, and the simple fact that people build in coastal areas because of its attractiveness and recreational and economic opportunities (Beatley, 2009; Klee, 1999). As Beatley (2009) notes, the complete avoidance of hazard areas is often not possible in many coastal areas.

The fact is that buildings and homes throughout the coastal areas are often subject to the high winds and surge associated with hurricanes and tropical storms (Beatley, 2009). Therefore, if the development itself can't be stopped, then perhaps building standard and code requirements can reduce the likelihood of damage when the inevitable high winds and surge strike coastal areas. Klee (2009, p. 106) states that "coastal hazards can be reduced through prudent design and construction of structures." He further mentions that designs which allow the passage of wind and water around and under structures have been found to be the most effective at reducing damage. Building standards may include traditional building codes, flood proofing requirements, retrofit requirements for existing buildings (Olshansky & Kartez, 1998), and wind hazard resistance technology for new and existing homes (Beatley, 2009).

2.4.5 Information dissemination and awareness strategies

Information dissemination strategies and hazard awareness programs are strongly recognized as significant components of hazard mitigation planning. In some sense these types of programs reflect a commitment to engage with the community through increasing public participation in mitigation planning activities and through increasing awareness of natural hazards and the risks they pose (Lindell & Perry, 2006; Olshansky & Kartez, 1998). Oftentimes people think that natural hazards have such a low probability of occurrence in their area or they are so lacking in knowledge of what types of hazard adjustments they can undertake when they do understand the risks that they are unlikely to undertake the specific steps needed to reduce the hazards vulnerability (Ge, Peacock, & Lindell, 2011; Hyndman & Hyndman, 2006; Peacock, 2003). Even in situations where many “old-timers” know what to do, given the high mobility rates for coastal populations, it is not surprising that residents of coastal communities in Florida who had not experienced a disaster were not likely view mitigation as a major concern (Godschalk, Brody, & Burby 2003; Peacock, 2003). Through hazard awareness programs, communities can attempt to enhance voluntary actions on the part of citizens, builders and developers to undertake hazard mitigation actions.

Hazard awareness strategies can be a crucial step toward successful implementation of other hazard mitigation policies. Hyndman & Hyndman (2006, p. 9) state that public awareness will help people in adopting mitigation policies in order to avoid potential impacts or at least "modify their behaviour or their property to minimize such impacts." In addition, Beatley (2009) states that, while not preventing hazardous development, the strategies such as hazard disclosure and hazard zone signs can at least put coastal property owners, developers, and local officials on notice that future dangers do exists and increase awareness of coastal hazards and their impact. Other studies also found that educational programs introduced by local governments to individuals or groups in their communities can, in turn, increase the level of commitment of local government officials toward hazard mitigation policies (Norton, 2005b; Robins, 2008).

The awareness strategies and programs for hazard mitigation in the coastal areas may include public education programs; real estate hazard disclosures in all transactions in addition to mandatory flood disclosures for homes purchased using a mortgage; posting of warning signs indicating high hazard areas; programs to encourage the purchase of insurance; technical assistance and training to builders, developers, and property owners for mitigation; hazard information centers; and training materials provided in multiple languages (Beatley, 2009; Berke et al., 1996; Brody & Highfield, 2005; Burby, 1998; Godschalk et al., 1999; Olshansky & Kartez, 1998; Srivastava & Laurian, 2006).

2.4.6 Incentive tools

Incentive tools are non-mandatory strategies that can be used to stimulate property owners, builders, developers, and even whole communities to engage in hazard mitigation practices or adjustments (Daniels & Daniels, 2003; Tang et al., 2011). Some of these strategies are within the purview of local communities as they try to shape the nature of development within their jurisdictions. However there are also federal programs that seek to shape the behavior of jurisdictions, particularly with respect to flooding mitigation.

2.4.6.1 Local incentive programs and policies

In general, local incentives attempt to shape the behavior of developers and land owners by offering a variety of rewards that promote development that reserves the natural environment or promotes hazard mitigation. These strategies can, for example, allow developers to exceed development limits set by current zoning regulations in return for certain concessions, which in this case enhance the mitigation status of development. When used as a mitigation tool, these strategies might encourage developers to avoid building in high hazard prone areas, incorporate enhanced mitigation technologies into building designs, or cluster structures on portions of the site farthest away from wetlands, by, for example, allowing higher density development or exceedance of height standards.

Another example of an incentive based approach might be Transfer Development Rights (TDR) (Beatley, 2009). In this strategy, coastal communities designate both conservation sending zones, such as an open space directly along the coast or a natural wetland, where development is not permitted or is to be discouraged, and receiving zones, where additional development density is permitted by acquiring the transferred development rights (Beatley, 2009). Another strategy is the simple use of density bonuses under which, for example, a developer might incorporate enhanced mitigation technologies into the building designs – say utilizing higher wind standards for roof coverings – in order to be allowed to increase development densities.

2.4.6.2 Federal incentive programs

There are also federal programs that seek to enhance or promote the adoption of mitigation actions by whole jurisdictions through the federal flood insurance program. The National Flood Insurance Programs (NFIP), which was established in 1968, is considered a federal incentive that provides flood insurance to residents of participating communities (Schwab et al., 2010). The NFIP has played a significant role in floodplain management and reducing risk and development in floodplain areas by demanding the adoption of building and land preparation standards in order to enable residents within a community or county to qualify for insurance (Holway & Burby, 1990). In a similar manner, many state-supported wind insurance programs demand higher building standards and inspections to qualify for coverage. In addition to the NFIP, FEMA also offers Community Rating System (CRS) as an integral part of the NFIP. This program provides flood insurance premium discounts for residents if the community that undertake floodplain activities above and beyond the minimum NFIP requirements (Schwab et al., 2007). CRS programs include activities such as (a) public information activities, such as providing elevation certificates and map information services; and (b) mapping and regulatory activities, such as establishing addition flood data, maintaining flood data, and introducing higher regulatory standards in addition to the NFIP minimum standards, such as foundation protection and more stringent building improvement rules (FEMA, 2007). Interestingly recent research has clearly shown that involvement by jurisdictions in both Florida and Texas in the CRS can substantially reduce flooding losses (Brody et al., 2011).

2.4.7 Financial tools

Local and state governments have the power to levy taxes, charge administrative fees, and make special assessments, which can be used not only for the collection of revenue, but also to integrate mitigation into the development process (Schwab et al., 2007). Financial tools may also be used to more equitably distribute the public costs of private development (Olshansky & Kartez, 1998). Financial tools include lower tax rates for preserving specific coastal areas as open space by limiting development intensity, special tax assessment for specific coastal areas, and impact fees for the development of specific coastal areas (Tang et al., 2011). In other words, local jurisdictions can encourage particular land use and land use patterns through adjustments in taxation policy by establishing economic and financial incentives to preserve, maintain, or create desirable features, or disincentives to discourage undesirable development patterns (Beatley, 2009, p. 82). Lower taxes or special taxes can also be employed as incentives for building designs that include mitigation or resilience features beyond what is required by codes (Beatley, 2009).

2.4.8 Property acquisition programs

While not without challenges, local governments are allowed to acquire and hold property for public benefit and use the property to secure public ownership in high-hazard areas (Beatley, 2009). In addition, local governments can acquire property, to conserve critical ecosystems or natural features, such as wetlands, maritime forests, and estuaries, as well as to provide open space for recreational benefits to their communities (Beatley, 2009; Schwab et al., 2007). The specific tools and strategies may include pre-disaster fee simple purchases, acquisition of development and easement rights, and relocation of existing structures in the hazardous areas. A fee simple purchase transfers full ownership of the property, including the underlying title, to another party, in this case the community (Beatley, 2009; Schwab et al., 2007; US Forest Service, 2011). By contrast, an easement is a legal agreement between a landowner and an eligible easement holder that restricts future activities on the land to protect its value for natural protection or conservation (US Forest Service, 2011). These strategies that strive to remove at-risk property from the private market can be useful mitigation tools, as they reduce the possibility of inappropriate development and prevent the future exposure and vulnerability that development would cause (Beatley, 2009; Schwab et al., 2007). However, these programs can be costly for local government, although “in the long run it is often less expensive to acquire and demolish a building than to repeatedly provide for its construction.” Property acquisition also saves the cost of rescuing people who live in these structures (Schwab et al., 2007, p. 263).

2.4.9 Critical public and private facilities

Directing the location of public infrastructure and critical facilities outside hazardous or environmentally sensitive areas can also enhance local mitigation efforts. This can reduce the cost of repairs and replacement following a disaster, by simply keeping these features of the built environment out of harm’s way. Locating critical public and private facilities include police stations, fire stations, hospitals, and emergency operation centers in safer areas helps ensure that the response capability of the local government is not impaired during a disaster (Schwab, et al., 2007). In other words, these critical facilities should be sited outside of high-risk locations and in places where, in the event of a major community disruption, they will remain functional (Beatley, 2009, p. 74). This means that essential community lifelines and infrastructure should be designed and integrated into the local jurisdictions' land use plans and policy to reduce exposure and vulnerability and ensure operability (Beatley, 2009). Following such policies can also set a public example and reflect the seriousness with which hazard mitigation issues should be considered. It can also steer development out of hazardous areas indirectly by stimulating development closer to these facilities and infrastructure.

2.4.10 Private and public sector initiatives

Local jurisdictions often have limited resources for mitigation planning, particularly funding for acquisition, which often becomes a significant challenge for coastal communities (Beatley, 2009). Therefore, local jurisdictions in some areas of the country have begun to explore more creative ways to raise funds and other initiatives for insuring that development does not occur in hazardous or environmentally sensitive areas. These initiatives may include land trust and public-private partnerships for land acquisition or easements (Beatley, 2009; Scwab et al., 2007). Land trusts can be created by raising funds from private, often non-profit, entities to purchase and preserve natural land through a variety of means, including facilitating the donation of scenic areas and space easement (Beatley, 2009). Beatley (2009, p.80) discusses, for example, the Maui Coastal Land Trust which is a nonprofit, nonpolitical land conservation organization aimed at preserving and protecting coastal lands in Maui for the benefit of the natural environment and current and future generations. Initiatives of this type can also be undertaken in the form of public-private partnerships in which entities such as land banks, which can be "governmental or quasi-governmental in nature" (Beatley, 2009, p. 81), can buy land and hold it until appropriate uses or development strategies can be formulated for its use. In addition, public-private partnerships can be created by bringing together various players such as businesses, researchers and academics institutions, and non-profit groups to develop integrated strategies to reduce and control the nature of development and exposure to coastal hazards by purchasing land or easements on existing holdings (Schwab et al., 2007).

2.4.11 Employing professionals for mitigation

Utilizing professionals to assist local jurisdictions in building mitigation can be important, particularly for communities that lack these professional resources on their own staffs. Schwab (2010), for example, mentions that communities without a permanent planning staff tend to hire planning consultants to assist in multiple tasks such as drafting and implementing the codes and zoning regulations that govern land use. This is important as planners are often, or should be at least, more formally trained to understand how hazards should influence those tasks and processes. In addition, planners need other professionals to be involved because hazard mitigation often requires highly technical information and data sources (Schwab, 2010). Geological consultants may help to identify suitable building sites and engineering consultants may help to develop special building techniques in hazard prone areas (Tang et al., 2011). Cigler (2009) found that the Louisiana Coastal Protection and Restoration (LACPR) considered the use of professionals and technical expertise as one of the important themes in guiding initiatives for post-Katrina and post-Rita hazard mitigation in the Gulf coast. There are a variety of ways professionals might be employed by local jurisdictions such as 1) the identification of suitable building sites for public infrastructure and facilities, 2) the development of special building techniques and codes for hazard prone areas, and 3) the performance of windstorm/roof inspections.

2.4.12 Summary of non-structural mitigation policies and tools

Section 2.4 has sought to highlight the variety of land use and development policies that have been identified in the literature as potentially effective strategies for enhancing community hazard mitigation. These strategies stand in stark contrast to more "structural" approaches in that they seek to keep development out of harm's way or at least in relatively safer areas and promote the preservation of environmental resources that might also mitigate the harmful effects of natural hazards. Furthermore, these policies seek to insure that development occurring in higher risk areas is built in a manner more appropriate to the hazard exposures of those areas. These strategies are the focus of this dissertation in that it will seek to identify factors that shape the adoption and extent to which these policies are employed by local jurisdictions. The questions to be addressed in the following sections focus on factors that influence the adoption and implementation of these land use and development policies.

There are many factors that influence whether or not a community might utilize land use and development regulations. Kang (2009, p. 51-53) classified these into three broad sets: (a) factors controlled by local governments (internal factors), which are categorized into two groups--factors controlled by the planning process, and factors associated with the capacity of planners and the planning agency; (b) factors uncontrolled by local government (external factors, situational factors) which include disasters or hazards occurrence, community wealth and resources, political culture that supports regulations, mandates or assistance from state and federal government, environmental constraints, and population density; and (c) factors that can be affected by both internal and external causes such as development pressure on hazardous areas and built environmental change as a result of development. While these categories offer a way of considering factors that might shape the extent to which jurisdictions employ non-structural mitigation tools, the degree to which factors in these categories are completely "under the control" of local jurisdictions governments is quite problematic. This is particularly the case when considering, as this dissertation will, jurisdictions ranging from small through very large municipalities and counties of various sizes.

For the purposes of this study, factors influencing the adoption of land use and development regulations will be more simply categorized into three groups. The first two groups are two broad sets of factors generally associated with capacity and commitment. The last set is control factors that are generally suggested by the literature and of import for the particular sample utilized in this dissertation. These controls will include a range of factors such as, hazard exposure, location in the Coastal Management Zone, type of jurisdiction, and population characteristics. But, most importantly, while the literature more often than not employs a variety of measures thought to be related to capacity and commitment and makes generalizations regarding the relative importance of these factors, little has been attempted to specifically develop measures of these two important concepts. Following sections will discuss the literature with respect to these two key factors, as well as some of the control factors, in an attempt to develop a broader framework for the measurement of these concepts and the development of an overall model to be employed by this research.

2.5 Local planning capacity and commitment toward coastal hazard mitigation

Capacity and commitment have been considered key factors in hazard mitigation particularly in U.S. where local communities are increasingly being considered as being the first to provide response to hazards, particularly when it comes to flooding problems (Brody et al., 2010). Most recent studies show that the general public expects government, particularly at the local level, to be prepared and to respond to environmental disasters (Basolo et al., 2009; Beatley, 2009). With the adoption of the DMA2000 came added responsibility for local jurisdictions to plan for local vulnerabilities to any type of hazard. Under this act, local jurisdictions are encouraged to participate in the development of Local Hazard Mitigation Plans (LHMPs). As part of the planning process local jurisdictions are expected to develop lists of mitigation actions, consistent with hazard risks, to target potential dollars obtained through the Hazard Mitigation Grant Program (HMGP), Pre-Disaster Mitigation Grants, and other mitigation resources (FEMA, 2000). These grant programs are part of the package of funding that state and local governments might receive. While it is possible to receive these funds prior to a disaster, they are generally provided after an event, and meant to be utilized during a window of opportunity that opens when communities are rebuilding after a disaster (Schwab et al., 2007). In many respects, these programs, tied as they are to local jurisdictions having developed a hazard mitigation plan, are like the National Flood Insurance Program (NFIP) which provides incentive for local governments to adopt mitigation measures (Brody et al., 2010; Schwab, et al., 2007).

While both the CRS and DMA 2000 are designed to promote the adoption of mitigation strategies, both structural and non-structural, these programs have met with mixed results. These mixed results are clearly seen in recent work assessing the nature of hazard mitigation actions proposed by local jurisdictions along the Texas coast (Kang et al., 2010; Peacock et al., 2009). In their analysis of Texas coastal hazard mitigation plans, Peacock and colleagues (2009) found that there was a total of 836 mitigation actions proposed by the 130 jurisdictions participating in these plans, with 814 of these representing single actions that could be easily classified. The largest single category of actions proposed by these plans, (34.4%), focused on structural mitigation actions, but the second largest category (25.8%) was related to regulatory, planning, policies and issues, followed closely by emergency management related mitigation actions (24.8%). Among the actions focused on regulatory and planning policies, the vast majority were generally limited to improving building codes and standards, funding land/property acquisitions, or retrofitting private structures. Actions related to establishing policies and development regulations like low density conservation zones, overlay zones, transfer of development rights, cluster developments, impact fees, setbacks, dedicated open spaces for hazard zones, and locating public facilities were only mentioned in a few plans.

Unfortunately, almost no mitigation actions were related to natural resource protection; in fact only one plan mentioned wetland preservation. The general sense from their findings is that there was a tendency to focus mitigation actions on structural solutions, with some consideration of non-structural mitigation solutions related to land use planning policies.

While incentive based federal policies, like DMA 2000, apparently have some effectiveness in stimulating the adoption of mitigation actions, the results from research on hazard mitigation planning suggest that the nature of the actions adopted tend to focus on structural techniques, while the adoption of land use and development regulations seems to be more mixed and variable. The key question to be addressed by this dissertation is what factors shape actual adoption and the extent to which these land use and development policies are actually implemented by coastal jurisdictions along the Texas coast. While many factors have been proposed within the literature, two of the more frequently cited factors are related to community capacity and commitment. The following sections will address these two concepts. As will be seen, the literature is often unclear in differentiation between capacity and commitment, allowing for a good deal of overlap. However, the discussion will begin by seeking clarity between these two factors, as well as examples from the literature that appear to confound them.

2.5.1 Community capacity

The term capacity, when applied to the ability of a community or organization to undertake some action, has been used in many fields such as public administration, organizational management, resource management, health sciences, and community and international development for the last few decades (Ivey, Loe, Kreutzwiser, & Ferreyra, 2006). Capacity has been defined in a variety of ways, and depending on the disciplinary focus, can have many different emphasis areas and dimensions. Arguably, the concept of capacity or associated theories are more widely employed in the fields of public administration and organizational management and this has had a great influence on planning scholars and researchers.

In its most simple form, capacity represents an organization's "ability to perform work" (Yu-Lee 2002, p. 1). In the non-profit sector, capacity is defined as a set of management practices, processes, or attributes that help organizations to fulfill their mission (Eisinger, 2002; Letts, Ryan, & Grossman, 1999). Meanwhile, in the public sector, some reviews of the literature suggest a rather fragmented approach to the use of the term "capacity," and, according to Christensen and Gazley (2008), the problem of defining and measuring capacity started nearly 30 years ago. Over time, the basic definition has been somewhat elaborated in the literature and a variety of synonyms have been offered and employed interchangeably, including terms such as capability, ability, and capacity building (Alaerts, Hartvelt, & Patorni 1999; Chaskin, 2001; Gargan, 1981; Honadle, 1981). Table 2.5 displays examples of selected definitions of capacity that have emerged primarily from public administration literature.

Table 2.5 Selected definitions of capacity in the field of public administration

Honadle (1981, 576)	Capacity is the ability to anticipate and influence change, make informed and intelligent decisions about policy, develop programs to implement policy, attract, absorb, and manage resources and evaluate activities to guide future action.
Gargan (1981, p. 652)	Local government's capacity is defines as "its ability to do what it wants to do."
Baser & Morgan (2008, p. 32)	Capacity is the term that refers to "the overall ability of an organization or system to create public value."
Grindle & Hilderbrand (1995, p. 445)	Capacity is the ability to perform appropriate tasks effectively, efficiently and sustainably.
Morgan & Taschereau (1996)	Capacity is the ability of individuals, groups, institutions, organizations or societies to identify and meet development challenges in a sustainable manner.
Fiszbein (1997, p. 1031)	Local capacity is an enabling factor and the effective existence, at the local level, of the tools that make it possible for local government to perform successfully.
Bowman & Kerney (1997, p. 19)	Capacity is the ability of government to respond effectively to change, to make decisions efficiently and responsively, and to manage conflict.
Ingraham, Joyce,& Donahue (2003, p. 15)	Capacity is government's ability to marshal, develop, direct and control its financial, human, physical and information resources.
Gerber & Robinson (2009, 347)	Local capacity is government performance to reach the goal.

The multiple definitions that surface in the field of public administration which are discussed thoroughly by Christensen and Gazley (2008) generally suggest that capacity is complex. Capacity may be used at times to describe both the mean to an end and the end (Honadle, 1981). Capacity, when assessed in terms of the internal organizational qualities, comprises human and capital resources while terms of external dimensions include financial support, networks of supportive relationships, sources of training, and political support (Christensen & Gazley, 2008). These measures are related to what Robins (2008) defines as the capital elements of capacity, which are identified as human, social, institutional, and economic capital. These approaches include both tangible and intangible elements, including not only the number of staff and facilities but also their specialized skills, the strength or quality of organizational leadership (Christensen & Gazley, 2008; Robins, 2008), as well as values, norms, experience, networks and relationships (Robins, 2008), and accomplishment of local political official goals (Gargan, 1981). Table 2.6 displays a summary of many of the elements and characteristics often suggested to be indicators of capacity in the literature.

In light of these various approaches to conceptualizing capacity, the elements and characteristics of government that are proposed to measure capacity are quite diverse. Indeed, Christensen & Gazley (2008) suggest that capacity is a "far from *unidimensional* concept" (p. 273). The fact that scholars use two or more elements in defining capacity reflects the complexities of its dimensions and characteristics.

From Table 2.6, it can be seen that the most often mentioned characteristics or key indicators of capacity are personnel or human resources with their knowledge and skill. Another significant factor is financial resources, which have to be available and flexible for implementing programs of various sorts. In addition, scholars generally agree that qualified officials who can provide leadership and understand institutional goals may also be keys to institutional capacity.

Table 2.6 Key elements of institutional capacity in public administration and resource management

Researchers/scholars	Characteristics, elements, and dimensions of institutional capacity
Harvelt & Okun (1991)	- Human resources - Staffing - Technical expertise - Financial resources
Grindle & Hilderbrand (1995)	- *Institutional Context*: concurrent policies, rules regulation, budgetary support, role of the state, management practices, formal and informal power relationship - *Task network*: communication and interaction among primary, secondary, and support organizations - *Organization*: goals, structure of work, incentive system, management/leadership, physical resources, formal and informal communication, behavioral norms, technical assistance - *Human Resources*: training, recruitment, utilization and retention
Handmer (1996)	- Emphasis on regulation and performance - Consistent with higher-level goals - Enforcement of management services (enforcement mentality, flexibility, adaptability, a willingness and ability to negotiate) - Personal networks, sources of help and advice - Access to technical expertise - Adequacy of local government funds
Ingraham et al., (2003)	- Financial - Human resource - Capital - Information technology system
Morison & Brown (2007)	- Technical assistance/support - Flexible funding for plan development - The creation of a locally representative management committee - Leadership
Robins (2008)	- *Human capital*: knowledge, skills, experience - *Social capital*: trust and reciprocity, values, attitude and behavior, commitment, motivation and sense of place, networks and relationships - *Institutional capital*: governance arrangements - *Economic capital*: infrastructure, financial resources
Gerber & Robinson (2009)	- Institutional performance to reach the goal - Vertical and horizontal coordination

Also evident from the information in this table is that there are a number of indicators that are perhaps suggestive of commitment when dealing, for example, with issues of adherence to norms and values (Robins, 2008), as well as performance attainment, networking among organizations, coordination, and leadership (Gerber & Robinson, 2009; Handmer, 1996; Robins, 2008). The following section addresses commitment specifically.

2.5.2 Community commitment

Compared to capacity, there is a no clear definition of commitment, particularly institutional or organizational commitment. Most commitment definitions and measurements discussed in the literature are drawn from management and sociological perspectives, which focus on an individual's commitment within an organization or society (Kanter, 1968; Reichers, 1985). In this regard, commitment is "a process of identification with the goals of organizations" (Reichers, 1985, p. 465) and "a process through which individual interests become attached to the carrying out of socially organized patterns of behavior" (Kanter, 1968, p. 500). In terms of public administration, commitment is defined as the willingness of an individual or group to recognize the importance of specific issues in their areas (Christensen & Gazley, 2008). In addition, commitment is defined as a duty or pledge to values and goals and ignites actions (Miller 2000; Reichers, 1985).

Unlike capacity, institutional commitment elements and dimensions are rarely defined. Most indicators that seek to measure commitment are based on the personal and individual commitment towards organizations, institutions, and society in general. In this regard, intrinsic variables such as satisfaction, expectation, self efficacy, and participation in the organization are often used to measure commitment (Miller, 2000; Reichers, 1985). Commitment also consists of a belief in and acceptance of organizational goals and values and the willingness to exert effort towards organizational goal accomplishment (Reichers, 1985, p. 468). Perhaps these individual characteristics of commitment can be a guide toward assessments of group or institutional commitment. However, these concepts have also found play in the planning literature addressing issues of hazard mitigation planning and policy adoption. The following will examine the usage of capacity and commitment concepts within the planning and hazards field.

2.6 Community capacity and commitment in the field of hazards

The concepts of capacity and commitment have also been employed in a variety of areas within the disasters and hazards. The majority of this research has focused on plan quality analysis by assessing natural hazard components in comprehensive or land use plans (Berke et al., 1996; Burby & May, 1998; May, 1993; Norton, 2005a; Norton, 2005b; Tang, 2008, Tang et al., 2009; Tang et al., 2011). Very little research has investigated the roles of commitment and capacity on local jurisdictions in the adoption and usage of land use and development regulations. There are two studies that look particularly at the planning practices for hazard mitigation. First, Burby & Dalton (1994) employed local government surveys to see how staff capacity and commitment influenced the adoption of limit development measures in hazardous areas. Second, Brody et al., (2010) launched surveys to flood plain administrators and planners to examine local government organizational capacity and flood mitigation policies in

Florida and Texas. The nature of these studies and their focus areas are displayed in Table 2.7 and discussed in detail below.

Table 2.7 Capacity and commitment and hazard mitigation policy research

Topic	**Examples of plan quality studies that address capacity and commitment**	**Examples of land use and development regulation studies that address capacity and commitment**
Coastal Zone Management (CZM) and local capacity	- Local CZM capacity in US Pacific - Tang, et al., (2011); Tsunami planning capacity in Pacific - Tang, et al., (2009); Coastal land use planning capacity in California - Tang (2008)	
Environmental planning and local capacity and commitment	- Local environmental planning - Tang and Brody (2009), Environmental planning and commitment - Burby & May (1998)	
Planning mandates, hazard mitigation, and local capacity and commitment	- Influence local capacity and commitment on plan quality/hazard mitigation policies - Berke et al., (1996), Brody (2003), Norton (2005a), Norton (2005b). State mandate and implementation effort, local capacity and commitment - May (1993)	- Staff capacity and commitment to adopt limited development of hazardous areas - Burby & Dalton (1994),
Flood mitigation and local capacity		- Organizational capacity for flood mitigation in Texas and Florida - Brody, Kang, & Bernhardt (2010)

There has been a growing set of studies that examines capacity of local governments to respond, prepare, and particularly to mitigate for impacts and losses due to any hazard event. Brody et al. (2010) defines the hazard mitigation capacity as the ability to anticipate hazards, make informed decisions about mitigation, and to implement effective policies. Meanwhile, May (1993) states that local capacity in hazard mitigation is the ability to perform planning mandates and to implement policy and reach the goals of reducing any impact of disasters. Others, seeking more concrete formulations, suggest that capacity is the availability of funding, staff, information, authority, and other institutional resources to plan and carry out mitigation efforts (Godschalk et al., 1999). Clearly the focus here is on the resources necessary to carry out planning activities.

May (1993) and Burby and May (1998) differentiate elements of agency capacity and mandate capacity. Agency capacity, they suggest, is an intrinsic condition within an institution such as a) adequacy of budget; b) technical expertise; c) authority to enforce rules and regulations. Meanwhile, mandate capacity is the ability to improve, perform and reach the goal, with elements such as technical assistance, state funds, maps, information, education, training, and equipment as well as the ability to authorize local fees and taxing in order to reach the goal in reducing any impact of hazard.

Other researchers have suggested that not only professional technical skills such as the ability to use GIS (Tang, 2008; Tang, Bright & Brody, 2009), but also the number of staff, are key elements of capacity (Berke et al., 1996; Burby & Dalton, 1994; Tang, 2008; Tang and Brody, 2009). In addition, since researchers are often focused on assessing plan quality, mandates for plan updates and local management efforts to improve plan quality are considered as significant elements of local capacity.

With regard to commitment, Burby and May (1997, p. 169-170) conceptualized local commitment toward hazard mitigation as a dedication on the part of local government to reach the goal of reducing the threat of losses from any type of natural hazards. This approach has the danger of becoming tautological, in that commitment is measured by success and a lack of commitment is inferred from failure. Yet, in seeking to promote mitigation, agencies may act in ways that are suggestive of the degree to which they are committed to the goals at hand. For example, commitment in hazard mitigation may include an agency's official endorsement of a goal, by who or what types of employees are put on the task, as in assigning higher status individuals to work on hazard problems, or the degree to which administrative officials such as planning directors and elected officials are active in promoting and endorsing mitigation goals and policies (Berke et al., 1996; Brody, 2003; Burby & Dalton, 1994; Burby & May, 1997; Godschalk et al., 1999; Norton, 2005b). In addition, Brody et al. (2010) suggest that commitment is also reflected in the degree to which regulations or policies are enforced.

Norton (2005b), in his North Carolina study, classifies commitment into three sources: (a) internal sources of commitment, which consists of familiarity with planning, sense of having community interests, sense of investment, sense of duty, case-specific decision making, responsiveness to constituents, tax base, litigation, and reelection concern; (b) political activism and institutional support consisting of citizen engagement, the existence of advocates (economic, environmental, and slow-growth), and staff commitment; and (c) elected officials' ideological beliefs related to, which consist of a strong purpose of planning, proactive role for government, and community interests over private property interests. Norton (2005b) found that the commitment of the local government in the plan-making process produces better plans and ultimately increases the likelihood of plan implementation. These findings are consistent with other research that suggests local commitment to planning and the implementation of local plans is essential for reducing hazard impacts (Beatley, 2009; Burby & May, 1997).

May (1993) defines commitment, similar to his definition of capacity by specifying two categories of commitment, agency commitment and mandate commitment, and each category has different indicators. Agency commitment consists of indicators such as the willingness of individuals to promote hazard mitigation goals as well as perform activities, whereas mandate commitment consists of indicators that drive actions such as commitment to public and local government awareness and participation. Other scholars also identify agency endorsement and willingness to promote hazard mitigation as indicators of commitment (Berke et al., 1996: Burby & Dalton, 1994).

While the above researchers clearly identify commitment as an important independent factor affecting the adoption of hazard mitigation policies, the fact that commitment and capacity are related and important, has led some researchers to simply focus on capacity and suggest that commitment is a facet of capacity. For example, Brody et al., (2010) note that capacity and commitment are intertwined and see local commitment is an indicator of capacity. They note that there is a strong correlation between capacity and commitment and argue that capacity and commitment are tied together suggesting that without commitment it is difficult to develop institutional capacity. The reverse can also be argued, without having capacity there will be little or no commitment. In light of the difficulties in distinguishing between the two concepts and their associated dimensions, many studies, have chosen to employ a host of variables related to both capacity and commitment in their analysis.

Table 2.8 offers a concise overview of the variety of approaches that have been employed to measure capacity and commitment as well as whether or not both concepts appeared in the particular research paper. Most early studies attempted to address both capacity and commitment, culminating with Norton's more recent work, which in addition to capacity, attempted to identify a variety of dimensions of commitment.

Table 2.8 Elements and dimensions of local capacity and commitment and hazard mitigation through land use planning research

Researchers/ scholars	**Capacity and commitment elements /characteristics**
May (1993)	- Mandate capacity: (a) technical assistance, (b) state funds, (c) mapping, (d) information education, (e) training, (f) equipment, and (g) authorization for local fees and taxing - Mandate commitment, to build local commitment: (a) public awareness, (b) local government awareness, (c) local participation, (d)local government actions, (e) sanctions - Agency commitment : (a) endorsement to hazard related goals **(HG),** (b) importance of HG to other mandates, (c) willingness of leadership to promote HG, (d) status of individuals working in hazard related activities - Agency capacity: (a) adequacy of agency staffing for meeting HG, (b) adequacy of agency expertise, (c) adequacy of relevant local and regional government officials, (d) adequacy of agency authority
Berke et al. (1996)	- Local capacity: (a) planning budget per capital, and (b) median housing values - Local commitment to hazard mitigation goals: (a) agency endorsement, (b) status of individuals working on hazard problems,(c) director willingness to promote hazard mitigation
Burby & Dalton (1994)	- Capacity: planning staff/population - Commitment : (a) agency endorsement of hazard mitigation reduction goals, (b) director's willingness to promote hazard mitigation
Burby & May (1998)	- Planning staff capacity: (a) adequacy of budget, (b) technical expertise, (c) authority to enforce rules and regulations - Commitment: commitment of elected officials
Norton (2005b)	- Local capacity: financial capacity, administrative capacity - Local commitment : a. Internal source of commitment: familiarity with planning, sense of having community interests, sense of investment, sense of duty, case-specific decision making, responsiveness to constituents, tax base, litigation and reelection concern b. Political activism and institutional support: citizen engagement, economic advocates, environmental advocates, slow-growth advocates, staff commitments c. Elected officials' ideological beliefs: strong purpose of planning, proactive role for government, community interests over private property

Table 2.8. continued

Tang (2008)	- Planning capacity: (a) number of planners, (b) plan updating ability, (c) information management ability, (d) professional technical skill, (e) integrated coastal management effort. - Public participation capacity: (a) participation format,(b) public notice channels, (c) public participation incentives
Tang, Bright & Brody (2009)	- Planning capacity: (a) number of planners, (b) plan element update, (c) GIS level, (d) regional collaborative effort - Environmental-assessment capacity: (a) assessment scope,(b) streamlining ability, (c) information management and sharing - Public participation capacity: (a) participation format, (b) public notice channels, (c) public participation incentives
Brody et al. (2010)	- Organizational Capacity: (a) commitment, (b) sharing information, (c) verbal communication, (d) network, (e) leadership, (f) financial resources, (g) available staff, (h) data quality, (i) adjustable staff, (j) long range planning, (k) human ecology, (l) ability to hire and retain staff

Yet, previous research mostly subsumed commitment under capacity. In addition, they have focused on plan quality and not actual implementation of hazard mitigation policies and strategies. When comparing plan development and plan implementation, it is likely that latter demands greater level of commitment, although one could argue that capacity as the first step in achieving goal is the hardest to achieve. Hence, regardless of various definitions and indicators of capacity and commitment employed, previous studies have generally found that some combination of these has positive consequences for the adoption of high quality plans for hazard mitigation and other community objectives.

This dissertation will return to patterns reflected in work that seeks to directly address both capacity and commitment as key factors impacting the use of hazard mitigation policies and strategies by local jurisdictions. The patterns with respect to the measurement of capacity are by far the most consistent in the literature – the focus has been on the financial and human capital resources held by jurisdictions to address planning issues. Hence, indicators related to budgets, personnel, data sources, and similar measures have generally been employed.

Consistent with much of the above, the primary indicators for capacity will seek to capture resources at the disposal of a jurisdiction for undertaking hazard mitigation policies and strategies. Assessments of commitment have been much more diverse in the literature, but there are common elements. For example there has been a general focus on indicators capturing the degree of dedication, engagement, or buy in on the part of jurisdictional and extra-jurisdictional agencies and constituencies.

As a consequence, commitment, in this research will be assessed in terms of the degree to which the community has sought out and procured commitments within and outside the jurisdiction for coordinated and concerted actions related to carrying out hazard mitigation programs and policies as well as dedication of time and effort on the part of agency personnel. Furthermore, as with previous research, the general expectation will be that capacity and commitment should both have positive impacts on a jurisdiction's use of hazard mitigation policies and strategies.

While variants of capacity and commitment are generally considered within research assessing plan quality and the adoption and usage of hazard mitigation policies and strategies, these are rarely the only factors considered by previous research. Indeed, there are also a variety of other factors that may influence whether or not a local jurisdiction implements hazard mitigation policies and strategies. The next section will briefly discuss these factors and how they may affect a jurisdictions use of policies that might reduce coastal hazard impacts.

2.7 Additional factors influencing the adoption of hazard mitigation policies and strategies

The literature suggests a number of other factors that may influence jurisdictional use of non-structural hazard mitigation policies and strategies and mitigation planning efforts. First, the type of local jurisdiction, whether it is a county or a municipality, has been considered an important factor that may influence the adoption and the extensive use of land use and development regulations. Tang (2008) employs jurisdiction type in evaluating local coastal land use planning capacities in California by classifying jurisdictions into coastal counties or coastal municipalities. This classification is important for several reasons. First, as mentioned earlier, municipalities are the only entities within the state of Texas that have the power of control over land use and development regulations (home rule) (Texas Municipal League, 2010). Second, counties in Texas have limited planning authority because they lack home rule and cannot pass ordinances unless specifically authorized by the state (Burby & May, 1997; Maxwell et al., 2010). Third, some studies suggest that a county is far less flexible than a municipality in its organizations and functions (Maxwell et al., 2010). Therefore, counties and municipalities may have different abilities to adopt and implement hazard mitigation policies and strategies.

Beside city-county differences, the location of a jurisdiction in a coastal zone, or more proximate to the shoreline has been identified as an important factor influencing the adoption of land use tools and development regulations. As mentioned earlier, previous studies have compared beach and inland communities. Norton (2005b), for example, categorizes local jurisdictions into beach and inland communities and beach and inland counties when he examines commitment to state-mandated planning. Similarly, work in Florida has identified communities located in coastal high hazard areas in Florida (Deyle, Chapin & Baker, 2008). This distinction of coastal versus inland is important because of the relative risk and hazard exposure of areas closer to the coast. Indeed, some studies have extended the notion of exposure and risk by identifying areas subject to specific hazards (Berke et al.,1996) and the size of jurisdictions located in hazard areas (Burby & May, 1998), as well as the proportion of jurisdictions encompassing sensitive natural areas (Norton, 2005b). The percentage of a jurisdiction in 100-year floodplains and storm surge areas has been recognized as a factor that influences the adoption of structural and non-structural mitigation (Brody et al., 2010; Kang, 2009). These factors are important because one would expect that the use of hazard mitigation policies and strategies would be greater in areas subject to higher exposure and risk, when compared to inland areas or areas outside flood zones. However, location in coastal zones can have other consequences as well.

Since this study focuses on Texas coastal areas, location of jurisdictions in the Texas' Coastal Management Zone (CMZ) might well have consequences for the abilities of these jurisdictions to implement hazard mitigation policies. Specifically, the identification of local jurisdictions in the CMZ is important not only because of potential hazard exposure, but also because of the opportunity of these communities to access financial as well as technical resources to boost their abilities to develop and implement land use and development regulation and hazard mitigation programs. One of the major programs that communities can participate in is the Texas Coastal Management Program that is supervised and administered by the Texas General Land Office. This program provides a host of resources to Texas jurisdictions located in the CMZ supporting a variety of activities from implementing policies for limiting growth, technical assistance, and public education programs that provide some hazard mitigation benefits (Burby & May, 1997; TGLO, 2011). The abilities of CMZ jurisdictions to gain access to these resources through a variety of grant programs may well enhance the ability of these areas to implement a host of hazard mitigation policies and strategies.

An additional factor is the experiential factor or hazard experience, which has been identified as a significant variable influencing, generally positively, the promotion of hazard mitigation programs (Lindell & Perry, 2000). The magnitude and severity of hazard impacts could drive local jurisdictions to adopt land use and development regulations that may enhance hazard mitigation practices. Some scholars examined the influence of hazard experience in various ways, such as through repetitive and catastrophic losses (Burby & Dalton, 1994), previous natural disaster (Burby & May, 1998), and specific hazard losses such as flood loss (Brody et al., 2010; Kang, 2009). In addition, areas that are exposed to frequent coastal hazards have been seen as a factor that influences communities' adoption of land use and development regulations.

An additional factor that may influence local jurisdiction capacity and commitment in adopting hazard mitigation policies are its population characteristics. These characteristics may include both population and population change, which in many studies have been considered influential factors in driving local jurisdictions' implementation of land use and development regulations (Berke et al., 2006; Brody 2003; Burby & Dalton, 1994; Burby & May, 1998; Norton, 2005b; Tang et al., 2011). Many assume that local jurisdictions with a larger population size have greater capacity in terms of financial resources and technical capacities (Tang et al., 2011), but they also have greater exposure of people at risk or vulnerable to hazard impacts. Meanwhile, communities with large populations exposed to high hazard risk can perhaps better motivate local jurisdictions to adopt policies that can enhance hazard mitigation. In addition, population growth is also relevant because jurisdictions with higher population growth rates face increasing demands over land and put more pressures on environmentally sensitive areas (Burby & May, 1998; Norton, 2005b; Tang et al, 2011; Tang, Bright, & Brody, 2009).

2.8 Toward a framework for assessing jurisdictional implementation of hazard mitigation policies and strategies

The focus of this dissertation will be to model and assess factors influencing the adoption and implementation of a variety of hazard mitigation policies and strategies by jurisdictions, counties and municipalities along the Texas coast. An important element of this research will be to assess the consequences of jurisdictional capacity and commitment for implementing hazard mitigation policies and strategies. This chapter has identified a host of mitigation policies and strategies that might be employed by jurisdictions. Specifically 12 different sets of strategies have been identified. These are: 1) land use and development regulations, 2) shoreline regulations, 3) natural resource protection, 4) building standards, 5) information dissemination/awareness programs, 6) local incentives tools, 7) federal incentive programs, 8) financial tools, 9) property acquisition programs, 10) critical public and private facilities policies, 11) private-public sector initiatives and 12) hiring professionals for building mitigation. In addition, this chapter has discussed research on hazard planning and the adoption of mitigation and land use policies, identifying the centrality of concepts like capacity and commitment in this research and the variety of approaches that have been utilized to operationalize these concepts. Finally other factors that have been identified in the literature that can influence the adoption of mitigation policies and strategies have been discussed.

The next chapter, Chapter III, will address how the data were collected for this research and briefly discuss some of the information collected, followed in Chapter IV, by an examination of how extensively the 12 hazard mitigation policies and strategies are being employed by local jurisdictions along the Texas coast. Chapter V will take the next major and critical step for this dissertation by addressing how the various mitigation policies and strategies as well as the critical concepts of capacity and commitment will be measured and employed in a more complete analysis of the factors determining the extent to which these mitigation polices are being implemented.

CHAPTER III

RESEARCH DESIGN AND METHODS

This chapter will focus on how the research that collected the data utilized in this dissertation was conducted. Specifically it will describe the study area, the sampling methods and sample frame, as well as the response rates and provide an assessment of sample. Finally, the data collected as part of this survey will be briefly discussed.

3.1 Study area

The study area for this research is the Texas coastal region. It was chosen, quite frankly, because the funding for its collection came from NOAA through the Texas General Land office with the mission of conducting a research project to better understand the nature of non-structural hazard mitigation policies and strategies, with an emphasis on development and land-use policies employed by coastal jurisdictions in Texas. This area is part of the US Gulf coast region, which is one of the most vulnerable coastal regions in the nation because it is subject to various weather related hazards such as hurricanes, tropical storms, and floods (Manyunga, 2008, p. 71; Peacock et al., 2009). According to the National Oceanic and Atmospheric Administration (NOAA) special projects' office, there are 41 counties in Texas that considered part of the coastal region (Crossett et al., 2004). NOAA defines a county to be part of the coastal region if one of the following two criteria is met: (1) at a minimum, 15% of the county's total land area is located within a coastal watershed or, (2) a portion of, or an entire county accounts for at least 15% of a coastal cataloging unit. A cataloging unit is the smallest hydrologic unit which the U.S. Geologic Survey classified at four levels: regions, sub-regions, accounting units, and cataloging units (Crossett et al., 2004). Table 3.1 presents a list of the 41 NOAA defined coastal counties in Texas and Figure 3.1 provides a map of Texas counties consider coastal by NOAA's definition. These are the target counties for this study.

Table 3.1 Coastal counties in Texas

Aransas, Austin, Bee, Brazoria, Brooks, Calhoun, Cameron, Chambers, Colorado, DeWitt, Duval, Fayette, Fort Bend, Galveston, Goliad, Harris, Hidalgo, Jackson, Jasper, Jefferson, Jim Hogg, Jim Wells, Kenedy, Kleberg, Lavaca, Liberty, Live Oak, Matagorda, Newton, Nueces, Orange, Refugio, San Patricio, Starr, Tyler, Victoria, Waller, Washington, Webb, Wharton, and Willacy.

3.2 Units of analysis

The target units of analysis for this research are all jurisdictions -- counties and municipalities -- located in NOAA defined coastal counties in Texas. Municipalities and counties are the targeted units of analysis given the focus of this research on "non-structural" mitigation policies and strategies. Counties and cities are the legal entities in Texas that can adopt and implement a wide variety of non-structural mitigation policies. More specifically, they can adopt and implement a host of broadly defined land use and development policies that can directly or indirectly address hazard mitigation. Of the two, municipalities or cities have much greater abilities to enact mitigation policies.

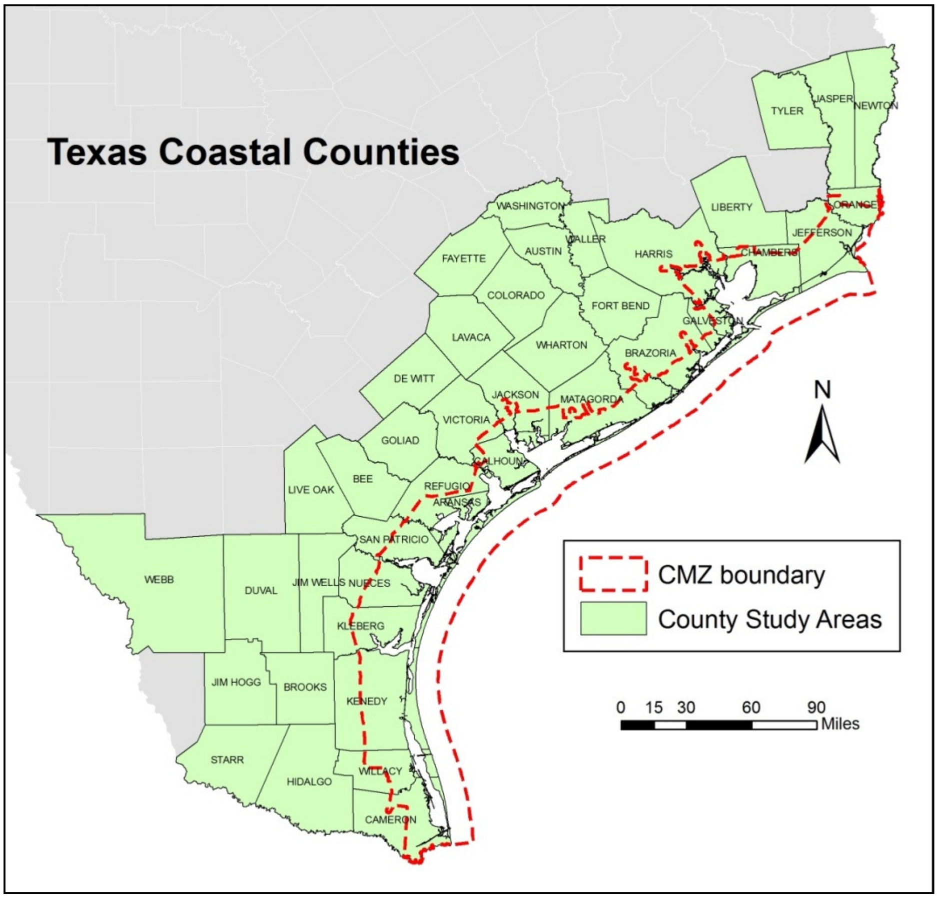

Figure 3.1 County study areas

Municipalities in Texas that are over 5000 individuals *and* have adopted home rule charters that have been approved by the legislature, have by definition *home rule* and therefore are legally capable of enacting and enforcing a large number of land-use policies related to zoning and they can adopt building codes. Cities that have not adopted a home rule charter or are smaller than 5000 citizens are termed general rule cities. Their powers are not as expansive as home rule cities, having much more limited powers that are defined or granted by the state legislature.

Given the importance of building codes for hazard mitigation, the nature of building codes and their adoption in Texas should be briefly discussed. First, it should be noted that there is not a statewide building code in the state of Texas, in that the state does not officially adopt and enforce building code regulations. In general, municipalities are the only entities in Texas that can and do adopt and enforce building codes. However, the Texas Department of Insurance (TDOI) does “adopt” a state recognized building code, with special wind provisions for “designated catastrophe areas”, which are essentially areas within the first tier of coastal counties and parts of Harris County. As informants within the TDOI noted, while all municipalities are suppose to adopt new building codes as they are recommended by TDOI, municipalities often fail to do so without penalty. As a consequence, there are in fact a variety of building codes in effect across municipalities in Texas ranging from the most recent International Residential Building Codes (IRBC) for 2009 to the much older Southern Building Code. One factor that does help insure compliance with more recent wind related construction codes is that many insurers do not cover wind hazard with standard homeowner policies which requires individuals to seek wind peril coverage from the Texas Windstorm Insurance Association (TWIA). To receive such coverage, however, requires compliance with the state’s windstorm codes and compliance is verified via inspection. Thus the state’s building code does indirectly influence building construction for all developments and households seeking wind coverage from the state’s wind pool. Furthermore, while it is generally true that municipalities are the only jurisdictions that can adopt building codes, as with so many things in Texas, this is not always the case.

Counties in Texas are known as “general purpose” governments providing a host of services to their citizens as well as administering State services. In addition to services like law enforcement, the construction and maintenance of roads, welfare and health, counties also address flood plain management issues. In addition, many counties have also been granted powers by the state that allow for a variety of land-use regulation within unincorporated areas of the county. Some of these are related to subdivision regulations and ordinances of variable levels of specificity and land-use issues along the shorelines of lakes and waterways. Importantly, the 2009 legislature also granted counties the ability to adopt building codes or more specifically to enforce the building codes adopted by their respective county seats within all of the county’s unincorporated areas. The addition of these extra abilities of some Texas counties to enact zoning-like regulations and building construction ordinances (see Texas Local Government Code - Section 231 and 233) have led some to note that some counties provide a considerable variety of services when compared to counties in the Midwest, Mid-Atlantic and New England (Maxwell et al., 2010).

Given the great degree of heterogeneity across municipalities in Texas and the piece meal manner in which the legislature has granted these land use and development regulations rights to counties and general rule cities makes it difficult to know exactly which of the 254 counties and 1,215 incorporated cities in Texas have particular land use planning policies. In light of the variability in which the citizens and households are served by their “local” jurisdiction, whether it is the city in which they reside or the county if they reside in unincorporated areas, this research will focus on gathering data from both types of jurisdictions in the Texas coastal zone. Furthermore, this research will not arbitrarily limit the size of the community to be surveyed. Since municipalities of any size are the backbone of land-use planning in Texas, this research attempted to survey any officially designated and state recognized municipality as well as all counties in the NOAA defined coastal zone. Based on these parameters, the initial sample frame for the coastal region included 267 local jurisdictions, of which there were 41 counties and 226 cities.

3.3 Sampling method

After initially identifying the 41 counties and 226 state-recognized cities, the next step in creating the sample frame was identifying key local informants that could be contacted to provide information about the jurisdiction's mitigation policies and governmental and community characteristics. The critical goal was to find an individual involved in city or county government who would be knowledgeable about various forms of mitigation policies related to land use, development and environmental controls, building code regulations, public and private programs created or utilized by their jurisdiction, and general characteristics of the government and community. Given the nature of data being collected, the primary individuals initially targeted for this survey were city planners and county judges. However, given the great heterogeneity of jurisdictional governing structures, our target group necessarily had to be expanded. Some city and county governments are quite large with individual departments addressing planning, building and infrastructure, as well as community development issues. Others were very simple operations with only a few staff or employees.

Therefore, the development of the sample frame required extensive investigative work using many sources including the web, the city/county data book, and extensive telephone conversation and interviews with multiple contacts at the local level. It was began by targeting planners and county judges, but when these individuals were not available, nonexistent, or unidentifiable other targeted individuals were contacted. These include city managers, building inspectors, flood plain administrators or managers, and local mayors. In the final analysis, a sampling frame was developed that consisted of 326 officials in jurisdictional governments to capture information on the 267 jurisdictions.

3.4 Methods of survey

There are many approaches that could be employed to implement the survey including mailed surveys, telephone surveys, face-to-face surveys, and more recently, internet surveys. There are advantages and disadvantages with respect to each approach. For instance, face to face surveys have major advantages in that the survey can be rather complex, but nevertheless manageable, since it will be implemented by a trained interviewer. However, face to face surveys would be very expensive to implement, particularly when the survey covers 267 local jurisdictions along the extensive Texas coastal region. Fortunately, because all informants were city or county officials and as part of the development of the sample frame contact information on the informants including their names, addresses, phone numbers, and email addresses were available alternative approaches were possible. Specifically, this research utilized an internet or web-based survey, supplemented by a mailed survey if needed.

An internet survey is not only a feasible but more importantly, a viable option because most officials with local governments can and do have access to email and the web via computers they employ in carrying out their official functions. A number of scholars have noted that for populations that regularly use the internet, the web has been found to be a useful means of conducting research (Couper, Traugott, & Lamias 2001; Sills & Song 2002). Furthermore, Dillman (2007) also noted that a self-administered web-based questionnaires are feasible because professional are likely to have access to the internet.

Internet surveys have a number of advantages making them more efficient when compared to mail and face-to-face surveys. The internet survey may significantly reduce data collection time required for survey implementation, especially when dealing with the large territories in the target area that often are significant barriers to conducting face to face surveys (Dillman, 2007). In addition, internet surveys often save time because the data are entered in an electronic format and therefore do not need to be transferred from the paper survey instrument (Kaplowitz et al., 2004). Furthermore, internet surveys also provide readily available data on the progress of the survey because researchers quickly know the number of undeliverable e-mail s as well as what time the web-based survey was opened and completed. This can improve sampling procedures (Paolo et al., 2000).

Internet based surveys also reduce the cost associated with surveying conducting the research compared to face to face surveys, the telephone interviews and even the printing and mailing costs associated with mailed surveys (Cobanoglu, Warae, & Moreo 2001; Dillman, 2007). Moreover, internet surveys, like mailed surveys, allow the respondent more flexibility in answering the questions. This was particularly important for this survey where the respondent is actually an informant asked to provide the most reliable and factual information about the jurisdiction and its policies. Hence, an internet survey enables the informant the time and ability to consult with others when answering questions.

For this research, the survey consisted of a self-administered web-based questionnaire that was distributed from the late summer of 2010 through early spring of 2011. There was also a supplemental data collection period during the summer of 2011 to obtain additional responses from some jurisdictions following elections and new appointments. The survey was conducted essentially following the Dillman's (2007) three-tiered approach for internet surveys. The initial contact consisted of an email, which had an attached cover letter containing a link to the survey's website along with a unique code. The initial contact was followed with a reminder email sent to the respondent's email address after one month. If no response was received after two months, emails and cover letters with the link to the questionnaire were resent. Follow-up reminders were sent via email unless the respondents needed a paper copy of the questionnaire. Internet questionnaires were supplemented by mail questionnaires in cases where jurisdictional informants did not have internet or email access or simply preferred filling out a paper questionnaire. Only eight informants requested the questionnaire in paper format.

In total, out of 267 targeted jurisdictions, data were obtained from 124, representing an overall response rate of 46%. There was some variability when comparing the response rates from counties versus cities. Of the 41 counties targeted, complete data were obtained from 26 counties, yielding a response rate of 63.4%. Of the 226 municipalities targeted, complete data was obtained from 98, yielding a somewhat lower response rate of 43.4%. As noted above, our desire was to initially target planners and county judges, but due to the complexities and variability of jurisdictional governments, the target sample was greatly augmented to include planners, building officials, flood plain managers, mayors or city managers, county judges and emergency or hazard management officials.

As completed surveys came in and the responses were monitored, it became evident that the response rates were varying by the size of the jurisdiction. Table 3.2 displays the response rates by size of jurisdiction which clearly indicates variable response rates by jurisdiction size. The lowest response rate was for communities of less than 1000 at 25%, increasing to 37% for communities between 1,000 and 4,999, 58.5% for communities between 5,000 and 14,999, 57.5% for communities between 15,000 and 49,999 and 71% for jurisdictions between 50,000 and 99,999. For jurisdictions between 100,000 and 299,999 the rate dropped back to 57%, but the final two categories, reflecting very large jurisdictions 300,000 or more had response rates of 100%. Clearly, the resulting sample under-represents smaller jurisdictions, a factor that will have to be considered when generalizing the results.[2]

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[2] It is interesting to note that while under representing in smaller jurisdictions, the responding jurisdictions contain 79.9% of the entire coastal population of Texas and 90% of the population of jurisdictions in the Texas CMZ.

Table 3.2 Response rates by jurisdiction population size

Population Size	Targeted Jurisdictions	Responding Jurisdictions	Response Rates
< 1,000	44	11	25.0%
1,000-4,999	94	35	37.2%
5,000 - 14,999	65	38	58.5%
15,000 - 49,999	40	23	57.5%
50,000 - 99,999	14	10	71.4%
100,000-299,999	7	4	57.1%
300,000 - 499,000	1	1	100.0%
> 1,000,000	2	2	100.0%
Total	**267**	**124**	**46.4%**

3.5 Data management

Data are being securely managed to maintain confidentiality of all survey informants. The data themselves cannot be considered anonymous, indeed they are associated with particular communities and are, actually are simply reports of information that are public records. The only time names were utilized was when we needed to contact survey participants to send them surveys and to send reminders to submit their questionnaires. Questionnaires were submitted with information about the local jurisdiction and the person completing the survey, however the job title of the informant and their names were decoupled from surveys.

3.6 Designing instrument

Before the survey was conducted, several steps were undertaken to ensure the reliability and validity of the data collection process. This process is illustrated in Figure 3.2. The first step was the design of the instrument itself. The instrument was initially developed based on instruments that were employed by previous studies (Brody et.al, 2010; Ge & Lindell, 2010). To improve the instrument and ensure it would work in the Texas context, questions were thoroughly discussed with experts. In addition, the instrument was also sent to practitioners to get their feedback. Some professionals were also asked to take the survey as a pre-test before the actual survey was conducted. After having feedback from experts, practitioners, and professionals, the instrument was discussed in a focus group and subsequently was revised to create the final survey instrument. This questionnaire's format was then modified to work as a web-survey design using Qualtrics software. This tailoring process insured it could be appropriately viewed on a web-based configuration and design (Dillman, 2007).

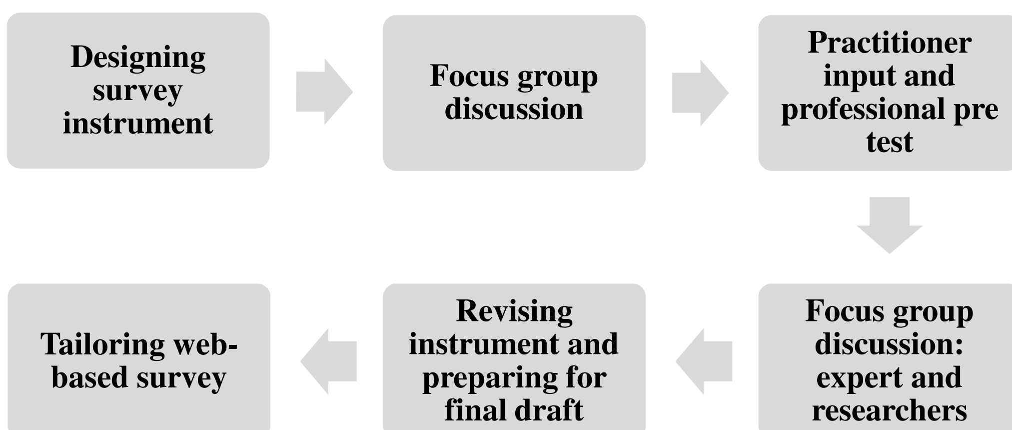

Figure 3.2 Instrument design process

3.7 Data collection and usage

The questionnaire collected a variety of information from the key informants. The questions from the survey instruments were divided into six sections. First section asked some general questions about jurisdictions and some land use planning issues. The second section asked about specific policies or actions that jurisdictions may employ in their general planning strategy or for specific hazard mitigation planning. The third section dealt with hazard experience and the fourth section asked about jurisdictional capacities and resources for undertaking hazard mitigation planning activities. The fifth section asked about coordination, cooperation and involvement specifically on how jurisdictions work with and coordinated with other jurisdictions and involve with agency within their jurisdictions and state level agency. The last section asked about general information such as annual budget and the number of staff members involved in hazard mitigation planning. The complete questionnaire can be found in appendices A.

In addition to the internet survey, secondary data sources were employed for this research. For example, the locations of the CZM areas were identified on a map provided by the Texas General Land Office. The 2010 Census data and the Fact Finder in the U.S. Census Bureau were utilized for population and population change variables. In addition, GIS based data were downloaded from the coastal planning atlas (http://coastalatlas.tamug.edu/). These GIS based data were used to calculate the jurisdiction's percentage of each type of land cover, the 100-year floodplain, and storm surge risk areas. All the data then were analyzed using STATA 11.

With this general knowledge of how the data were collected and the nature of the sample, the following chapter will present a brief descriptive analysis of the extent to which non-structural hazard mitigation strategies and tools are employed among coastal jurisdictions in Texas.

CHAPTER IV

HAZARD MITIGATION POLICY AND TOOL USAGE AMONG TEXAS COASTAL JURISDICTIONS

4.1 Introduction

The focus of this dissertation again is on the extent to which a variety of what, are generally referred to as non-structural hazard mitigation policies and strategies are being employed by coastal jurisdictions in Texas. Chapter II provided a systematic discussion of the variety of different non-structural hazard mitigation policies and strategies that are often identified by the planning and hazard mitigation literatures. As noted, there are many ways that these types of strategies and policies might be categorize; for the purposes of this research the classification was based on a synthesis of classifications generally seen in the planning and mitigation literature for addressing mitigation (Beatley, 2009; Daniels & Daniels, 2003). The resulting classification has 12 categories of similar non-structural mitigation strategies and tools that included: 1) land use and development regulations, 2) shoreline regulations, 3) natural resource protection, 4) building standards, 5) information dissemination/awareness programs, 6) property acquisition programs, 7) local incentives tools, 8) federal incentive programs, 9) financial tools, 10) critical public and private facilities policies, 11) private-public sector initiatives and 12) hiring professionals for building mitigation.

Table 4.1 Specific hazard mitigation policies and strategies

- Land use and Development Regulations
  1. Residential subdivision ordinance
  2. Planned unit development
  3. Special overlay districts
  4. Agricultural or open space zoning
  5. Performance zoning
  6. Hazard setback ordinance
  7. Storm water retention requirements
- Shoreline Regulations
  8. Limitation of shoreline development to water-dependent uses
  9. Restrictions on shoreline armoring
  10. Restriction on dredging/filling
  11. Dune protection
  12. Coastal vegetation protection
- Natural Resource Protection
  13. Wetland protection
  14. Habitat protection/restoration
  15. Protected areas
- Building Standards and Codes
  16. Building code
  17. Wind hazard resistance for new home
  18. Flood hazard resistance for new home
  19. Retrofit for existing building
  20. Special utility codes
- Information Dissemination and Awareness Programs
  21. Public education for hazard mitigation
  22. Citizen involvement in hazard mitigation planning
  23. Seminar on hazard mitigation practices for developers and builders
  24. Hazard disclosure
  25. Hazard zone sign
- Local Incentive Programs
  26. Transfer of development rights
  27. Density bonuses
  28. Clustered development
- Federal Incentive Programs
  29. Participation in the National Flood Insurance Program (NFIP)
  30. Participation in the FEMA community rating system (CRS)
- Property Acquisition Programs
  31. Fee simple purchases of undeveloped lands
  32. Acquisition of developments and easements
  33. Relocation of existing structures out of hazardous areas.
- Financial Tools
  34. Lower tax rates
  35. Special tax assessment
  36. Impact fees or special assessments
- Critical public and private facilities policies
  37. Requirements for locating public facilities and infrastructure
  38. Requirements for locating critical private facilities and infrastructure
  39. Using municipal service areas to limit development
- Public-private sector initiatives
  40. Land trusts
  41. Public-private partnerships
- Hiring Professionals:
  42. Hiring professionals to identify suitable building sites
  43. Hiring professionals to develop special building techniques
  44. Hiring professionals to conduct windstorm/roof inspection

Also as discussed in Chapter II were the variety of specific types of strategies and tools that are generally associated with each of these categories. Table 4.1 identifies the 44 detailed strategies what were associated with each of the 12 categories. Some categories (e.g., land use and development regulations) have a relatively large number of specific policies/strategies associated with them, while others (e.g. federal incentives or public-private sector initiatives) have relatively few. For each of the 44 specific planning policies/strategies, local planning informants were asked to assess the extent to which each is being employed by their jurisdiction. Informants were provided with response categories ranging from *not at all (1)* through *to a very great extent (4)* and since it is possible that some jurisdictions[3] did not have the legal capacity to undertake some of these strategies, a response category was provided to capture such an option. For the purposes of this and subsequent analysis, the response categories were recoded to better capture a simple scale reflecting the extensiveness to which each strategic or policy was employed. For example, while it may be important to know whether a jurisdiction has the legal capacity to enact a particular policy, the focus here is whether the jurisdiction employs the policy. Hence these jurisdictions that lacked the authority were equivalent to those that had the capacity but did not choose to exercise it. In both cases, the jurisdiction did not employ the policy and hence are equivalent and were recoded as zero (0). The full sets of recoded categories were not at all (0), to a small extent (1), to some extent (2) or to a great extent (3).

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[3] It should be noted again that, in Texas, it is important to be cautious in making blanket statements that certain types of jurisdictions can not undertake a specific policy. While it is generally true that only municipalities can adopt and enforce building codes, some counties also have this legal authority.

This chapter will be providing a descriptive discussion of the extent to which various types of non-structural mitigation policies or strategies are in use by the counties and municipalities in Texas coastal areas. The discussion will first examine to what extent various types of mitigation policies are in use by local jurisdictions in Texas coastal areas. The second section will examine the difference between municipalities and counties in the extensiveness to which these policies and strategies are employed.

4.2 Development and land use regulations

Table 4.2 presents the findings with respect to land use and development regulations within jurisdictions. Specifically, informants were asked about the seven different development and land use regulations displayed in the table which are 1) residential subdivision ordinances, 2) planned unit development, 3) special overlay districts, 4) agricultural or open space zoning, 5) performance zoning, 6) hazard setback ordinance and 7) storm water retention requirements.

The data in Table 4.2 show that residential subdivision ordinances are the most extensively employed strategies by local jurisdictions with 64.5% reported using them extensively and 18.6% to some extent. This is followed by hazard setback ordinances with 41.1% employing them to a great extent and 18.6% to some extent. This finding suggests that local jurisdictions are quite likely to use hazard setback ordinances, with nearly 60% using them at least to some extent. In addition, with respect to storm water retention requirements, it can be seen that 37.9% employ them to a great extent, and an additional 20.2% employ them to some extent. Again these results suggest at storm water requirements are also prevalent in a clear majority of jurisdictions. The other form of development regulation that is at least somewhat prevalent was to planned unit development. Only 26.6% of the jurisdictions report employing this approach to a great extent and at 16.1% employ them to some extent.

Table 4.2 Development and land use regulations

Development Regulations		not at all	small extent	some extent	great extent	Total
1. Residential subdivision ordinance	n	17	4	23	80	124
	%	13.7	3.2	18.6	64.5	100.0
2. Planned unit development		43	28	20	33	124
		34.7	22.6	16.1	26.6	100.0
3. Special overlay districts		70	14	27	13	124
		56.5	11.3	21.8	10.5	100.0
4. Agricultural or open space zoning		70	20	17	17	124
		56.5	16.1	13.7	13.7	100.0
5. Performance Zoning		90	15	12	7.0	124
		72.6	12.1	9.7	5.7	100.0
6. Hazard setback ordinance		42	8	23	51	124
		33.9	6.5	18.6	41.1	100.0
7. Storm water retention requirements		28	24	25	47	124
		22.6	19.4	20.2	37.9	100.0

In contrast, many fewer jurisdictions regulated land use and development using performance-based zoning. Specifically, 73% of jurisdiction reported that they did not use performance zoning at all and an additional 12% use them only to a small extent. Rather substantial percentages of jurisdictions do not use employ special overlay zoning districts (56.5%) or agricultural or open space zoning (56.5%) at all. Nevertheless, a far from insignificant 10.5% of jurisdictions used special overlay zoning districts extensively and nearly 22% employed them to some extent. Despite these latter findings, one would have to conclude that on the whole, zoning approaches appear to be used only on a limited basis among these jurisdictions.

The findings with respect to land use and development regulations show that local jurisdictions are generally more focused on trying to shape development via residential subdivision ordinances, and to mitigate through storm water retention requirements and hazard setbacks, with some limited introduction of more incentive based and flexible approaches like planned unit developments. These findings are somewhat similar to previous studies that suggested subdivision and hazard setback ordinance are often used in land use planning (Deyle, et al., 1998; Olshansky & Kartez, 1998). However, previous studies that suggest rather extensive use of zoning ordinances (Beatley et al., 1994; Godschalk et al., 1989) clearly do not hold among jurisdictions along the Texas coast, at least with respect to more progressive forms of zoning examined by this research.

4.3 Shoreline regulations

Table 4.3 displays the data on the use of regulations to limit and restrict the nature of development activities along shoreline areas. These shoreline regulations consist of 1) limitation of shoreline development to water-dependent uses, 2) restriction on shoreline armoring, 3) restriction on dredging and filling, 4) dune protection and 5) coastal vegetation protection.

Overall, these types of regulations were *not* very extensively used by the responding jurisdictions, although it must be pointed out that many of them, while they may have some form of shorelines, are not directly adjacent to the Gulf Coast. The data suggests that 87 localities (70.2%) never use regulations that limit shoreline development to water-dependent uses only. Conversely, only 10.5% used these restrictions extensively and 8.9% used them to some extent.

Table 4.3 Shoreline regulations

Shoreline regulations	not at all	small extent	some extent	great extent	Total
Limitation of shoreline dev. to water-dependent uses n	87	13	11	13	124
%	70.2	10.5	8.9	10.5	100.0
Restrictions on shoreline armoring	91	13	8	12	124
	73.4	10.5	6.5	9.7	100.0
Restriction on dredging /filling	71	12	20	21	124
	57.3	9.7	16.1	16.9	100.0
Dune Protection	105	4	5	10	124
	84.7	3.2	4.0	8.1	100.0
Coastal Vegetation protection	95	5	11	13	124
	76.6	4.0	8.9	10.5	100.0

Similarly, the vast majority at 73.5% of jurisdictions do not restrict shoreline armoring at all and only 9.7% use these restrictions to a great extent. In addition, the vast majority of jurisdictions, 57.3%, do not restrict dredging/filling, with only 16.9% employing these restrictions extensively. Furthermore, where the issue of being directly on the Gulf coast has it most significant consequence, very few local jurisdictions employ dune and coastal vegetation protection policies. The findings in the table shows that 84.7% do not have any kind of dune protection ordinances at all and nearly 76.6% do not protect coastal vegetation. Conversely only 8.1% of local jurisdictions employed dune protection to a great extent and 10.5% employed coastal vegetation protection extensively. As noted above, these findings can in no small measure be a consequence of the location of many of these jurisdictions. While all jurisdictions are part of the coastal region as defined by NOAA, almost two-thirds of sample jurisdictions lack coastal shorelines and just over 56% of sampled jurisdictions (70 of 124) are not located, either wholly or partially, in the Texas CMZ. Therefore, many of these non-CMZ jurisdictions may not even have coastal shoreline issues; hence shoreline regulations are not a priority for them.

Some small measure of consolation may be found in the following observations. When analyzing only CMZ jurisdictions, nearly 35% limit shoreline development to water dependent usages, 37% protect shoreline vegetation, and 39% restrict dredging and fill activities to at least some extent. However sizable majorities, even when restricting the analysis to CMZ jurisdictions, do not limit shoreline development (48%), armoring (52%), or dredging/filling (48%), or protect shoreline vegetation (56%) at all. While there are undoubtedly many factors influencing this lack of shoreline protection, these percentages are somewhat sobering.

4.4 Natural resource protection

Table 4.4 presents responses to natural resource protection regulations which consist of 1) wetland protection, 2) habitat protection/restoration, and 3) protected areas preservation. The findings suggest that on the whole these regulations are *not* very extensively used by coastal jurisdictions. The majority (54.0%) of jurisdictions do not engage in wetland protection at all, but 21.0% used these regulations extensively and an additional 15.3% use them somewhat. The findings also show that only 9.7% of communities engage in habitat protection/restoration extensively and most jurisdictions, 66.1%, do not engage in habitat protection or restoration activities at all. In addition, only 12.1% of communities utilize protected areas extensively and 62.1% of localities do not utilize this strategy at all.

Table 4.4 Natural resource protection

Natural Resource Protection		not at all	small extent	some extent	great extent	Total
Wetland Protection	n	67	12	19	26	124
	%	54.0	9.7	15.3	21.0	100.0
Habitat protection/ restoration		82	12	18	12	124
		66.1	9.7	14.5	9.7	100.0
Protected areas		77	17	15	15	124
		62.1	13.7	12.1	12.1	100.0

These relatively low percentages indicate that local jurisdictions generally do not employ natural resource protection approaches as a mitigation strategy. This suggests, albeit indirectly, that coastal communities in Texas do not fully understand or possibly appreciate the potential protection that these natural resources in the form of wetlands and natural habitats, through the ecosystem services they provide can serve as mitigation tools that reduce hazard impacts.

Interestingly, these results are not similar at all to those of Tang et al., (2008). While not directly assessing policy implementation, but rather the assessment of land use/comprehensive plans along the Pacific coastal region, they found that natural resource protection policies had a moderate frequency of mention in community plans. However, the above findings are similar to Olshansky & Kartez (1998) who found that few communities nation-wide used these tools. These findings are also consistent with

Peacock et al., (2009) who found that most of the communities participating in the development of local hazard mitigation plans, even those within the Texas CMZ, were not likely to propose hazard mitigation actions related to natural resource protection. Indeed, they found that only one jurisdiction proposed a hazard mitigation action that was focused on wetland protection/restoration.

4.5 Building standards

The building regulation standards and policies data includes information collected on five policy areas: 1) the current building code used by local jurisdictions, 2) flood hazard standards for new homes, 3) wind hazard resistance standards for new homes, 4) retrofitting for existing buildings, and 5) special utility codes. For most of these building standards regulations, each informant was asked to what extent the regulations were used in a manner similar to those discussed above. For the building code question however local jurisdictional informants were simply asked which building code their jurisdiction had adopted. The response categories included the 2009, 2006, 2003 and 2000 IRC/IBC, the much older Southern Building Code (SBC), no building code, and other. These response categories assigned so 3 reflected the adoption of the most current and, presumably most stringent, code.[4] Specifically, jurisdictions that adopted the most current code, the 2009 IRB/IBC codes, received a 3, those that adopted the 2006 or 2003 IRC/IBC codes received a 2, those utilizing the 2000 IRC/IBC or the

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[4] This assumption may not always be warranted. There have been historical periods, particularly periods with high levels of development, where building codes have been known to diminish in quality as was the case with building codes in Miami Dade county from about the 1950s through the late 1970s and early 1980s (see Peacock, Morrow & Gladwin, 2001).

even older southern building codes received a 1, and those with no building code received a 0.

The data on the extent of adoption for the five building standards/codes are reported in Table 4.5. Perhaps somewhat surprisingly, only 23.9% of the sampled jurisdictions reported having adopted the current 2009 IRC/IBC. An additional 46.5% of the jurisdictions have adopted either the 2006 or 2003 IRC/IBC. Overall then, 69.4% of coastal jurisdictions report having adopted one of the newer, 2003-9, international building or residential codes that have been recommended by the Texas Department of Insurance. Unfortunately, 11.3% of coastal jurisdictions are still utilizing either the oldest version (2000) of the IRC/IBC or the even older southern building code (SBC). And even more disturbing is the finding that 19.4% of the jurisdictions have adopted no building code whatsoever. Most of these jurisdictions are counties, which as noted earlier have limited capacity to adopt and enforce a building code, but some were cities. These findings suggest a significant percentage of coastal jurisdictions have either no building code, 19.4%, or are employing relatively out of date codes, 11.3%.

When comparing the findings for the remaining standards, it can be seen that flood hazard standards for new homes are by far the most extensively adopted and implemented regulations adopted by coastal jurisdictions. Specifically, 62.9% of local jurisdictions report using these standards extensively in their communities, while an additional 16.1% are employing them to some extent. However, there were still 12.1% of these localities that have no flood hazard standards for new housing at all.

Table 4.5 Building standards regulations

Building Standards		not at all	small extent	some extent	great extent	Total
Building code	n	24	14	57	29	124
	%	19.4	11.3	46.5	23.9	100.0
Wind hazard resistance for new homes		38	4	18	64	124
		30.7	3.2	14.5	51.6	100.0
Flood hazard standards for new homes		15	11	20	78	124
		12.1	8.9	16.1	62.9	100.0
Retrofit for existing building		42	27	23	32	124
		33.9	21.8	18.6	25.8	100.0
Special utility codes		50	18	20	36	124
		40.3	14.5	16.1	29.0	100.0

The implementation of building regulations for wind hazard resistance in new home was moderately high with 51.6% local jurisdiction reporting using these standards extensively and an additional 14.5% reporting using them somewhat. Nevertheless, 30.7% of coastal jurisdictions report that they have not adopted wind hazard resistance policies at all. The final two regulations, retrofitting and special utility codes, are not utilized extensively among coastal jurisdictions. Only 25.8% of the jurisdictions employ retrofitting standards extensively and 33.9% of them have no such polices for existing buildings at all. Similarly, 40.3% of coastal communities have no special utility codes and an additional 14.5% used them only sparingly. On the other hand, it should not be overlooked that 29.9% of jurisdictions do employ special utility codes extensively.

The observation that nearly 70% of coastal jurisdictions have adopted IRC/IBC codes from 2003 or later is a positive finding. However, it should be noted that, as Burby (1998) suggests, measures such as building codes and flood and wind standards, which often require elevating structures and installing hurricane clips, are effective in reducing losses for new construction and development, but have limited impact on losses to existing development. This of course assumes that more recently adopted codes are stronger in terms of hazard mitigation (Burby, 1998; Tang, 2008). Newer codes will have substantial effects on existing structures only when the renovations or repairs amount to more than 50% of the value of a structure. Overall, compared to other regulations examined thus far, local jurisdictions to appear to be making more extensive usage of building standards and codes as a tool in hazard mitigation analysis.

4.6 Information dissemination and awareness programs

Hazard information and awareness programs offer a mechanism through which land use practices and patterns might be altered voluntarily. The hope is that as residents, builders, developers and others gain a better understanding of their hazard exposure and risk they will make adjustments that will enhance the mitigation status of an area. Five strategies were asked of local jurisdictional informants concerning hazard awareness policies and programs. These programs are: 1) public education for hazard mitigation, 2) citizen involvement in hazard mitigation planning, 3) seminars on hazard mitigation practices for developers and builders, 4) hazard disclosure statements as part of real estate and other transitions, and 5) hazard zone signage. Table 4.6 displays the various responses for each strategy.

Interestingly, while not many jurisdictions employed public education for hazard mitigation programs extensively, it was by far most extensively employed of the hazard dissemination and awareness approaches considered. Only 17.7% of the jurisdictions used public education programs extensively and an additional 23.4% used them to some extent. Meanwhile, 30.7% never utilized these kinds of programs and 28.2% used them to only a small extent.

Table 4.6 Information dissemination and awareness

Information dissemination/ awareness	not at all	small extent	some extent	great extent	Total
Public education for hazard mitigation n	38	35	29	22	124
%	30.7	28.2	23.4	17.7	100.0
Citizen involvement in hazard mitigation planning	40	38	29	17	124
	32.3	30.7	23.4	13.7	100.0
Seminar on hazard mitigation practices for developers and builders	75	27	17	5	124
	60.5	21.8	13.7	4.0	100.0
Hazard disclosure	76	21	16	11	124
	61.3	16.9	12.9	8.9	100.0
Hazard zone sign	92	17	12	3	124
	74.2	13.7	9.7	2.4	100.0

Similarly, there is a very limited prevalence of utilizing citizen involvement in hazard mitigation planning. Only 13.7% of the communities reported using citizen involvement in hazard mitigation planning activities extensively and an additional 23.4% of them reported involvement of citizens to some extent. Unfortunately, only 30.7% of the jurisdictions report involving citizens to a small extent and 32.3% of them indicated that citizens were not involved at all in hazard mitigation planning. The findings also suggest that seminars on hazard mitigation practices for developers and builders were not commonly offered. Very few localities, only 4.0% of the jurisdictions hold these types of seminars extensively, while the vast majority, 60.5% never offer such seminars. Approximately 21.8% of jurisdictions offer these seminars to a small extent and additional 13.7% of utilize them to some extent.

There were 61.3% of the jurisdictions that that reported they do not require hazard disclosures at all during real-estate transactions. Only 8.9% require disclosures extensively with an additional 12.9% employing them to some extent. The least frequently used strategy for increasing public hazard awareness is signage clearly indicating hazard zones. Only 2.4% of the jurisdictions reported using hazard signage extensively, 9.7% of them employed such signage somewhat and 13.7% use these signs to a small extent. The vast majority, 74.2%, never use hazard signage.

It is interesting that, while information dissemination and awareness tools are known to be relatively inexpensive yet effective measures for promoting mitigation adjustment, especially voluntary adjustments, these policies are not being extensively implemented by local jurisdictions along the Texas coast. It is also interesting to note that these general findings stand in stark contrast to the observation that education programs are frequently proposed actions in the coastal hazard mitigation plans evaluated by Peacock and colleagues (2009). However, many stakeholders, particularly those in the “development” community, often shun programs like disclosure statements and signage that make it very obvious which areas within their communities are exposed to environmental hazards.

4.7 Property acquisition programs

As discussed in Chapter II, property acquisition and the purchasing of development rights are methods for preventing development from occurring in hazardous areas in the first place. Furthermore the relocating of structures out of hazards areas can have the same effect after questionable development has occurred or, because changes in the physical environment such as erosion, structures now threaten those structures. Table 4.7 displays the jurisdictional usage of three property acquisition programs: 1) fee simple purchases, 2) acquisition of development rights or easements, and 3) relocation of existing structures.

Table 4.7 Property acquisition programs

Property acquisition programs		not at all	small extent	some extent	great extent	Total
Fee simple purchase	n	94	9	16	5	124
	%	75.8	7.3	12.9	4.0	100.0
Acquisition of development rights or easements		94	14	12	4	124
		75.8	11.3	9.7	3.2	100.0
Relocating existing buildings		103	11	7	3	124
		83.1	8.9	5.7	2.4	100.0

The percentage of jurisdictions that employ fee simple purchases was very low. Indeed, only 4.0% of the jurisdictions used such mechanisms extensively and the vast majority (75.8%) never employed this method at all. Likewise, only 3.2% acquire development rights or easements extensively. Yet again, the vast majority of jurisdictions, 75.8% never attempt to obtain such rights or easements at all. Finally, an overwhelming majority of 83.1% of the jurisdictions have never relocated structures out of harm's way and only 2.4% employ such methods extensively.

The very low percentages of communities that employ these methods might be explained by the fact that the fee simple purchase and development right acquisitions programs are among the most expensive methods, particularly given the high cost of coastal land (Beatley, 2009). Local communities simply do not have the financial capital to undertake these types of programs. In fact, even in the aftermath of a disaster when communities can combine local resources with those of state and federal governments to purchase repetitive loss properties or properties that perhaps are subject to coastal setback requirements, local communities and even state governments avoid these acquisitions. In addition, fee simple purchases by governmental entities effectively delete these properties from property tax rolls and also require maintenance expenditures. Therefore, local jurisdictions often are loath to adopt property acquisition programs, despite the observation that these properties can often become community amenities in the form of parks and recreational areas. It should be pointed out that the above results are not necessarily surprising for they are similar to previous studies on plan evaluations that find that few communities used land and property acquisition programs (Olshansky & Kartez, 1998; Tang, 2008).

4.8 Financial tools

Informants were also asked specifically about three different financial strategies for addressing hazard mitigation within their jurisdictions. These were: 1) lower tax rates for preserving specific coastal areas as open space, 2) special tax assessments for specific coastal areas, and 3) impact fees or special assessments for the development of environmentally sensitive or hazardous areas. Table 4.8 displays the responses on financial tools/policies.

Table 4.8 Financial tools

Financial tools		not at all	small extent	some extent	great extent	Total
Lower tax rates	n	112	5	4	3	124
	%	90.3	4.0	3.2	2.4	100.0
Special tax assessments		115	3	5	1	124
		92.7	2.4	4.0	0.8	100.0
Impact fees or special assessments		113	5	4	2	124
		91.1	4.0	3.2	1.6	100.0

Compared to others policies and strategies examined above, these policies are by far the most unpopular when assessed in terms of the extent to which they are employed by sampled jurisdictions. Very few jurisdictions use these policies—90.3% of these jurisdictions to not use lower tax rates for preserving environmentally sensitive or hazards areas at all, 92.7% do not consider special tax assessments, and 91.1% do not levy special impacts fees or assessments for developing in high hazard or environmentally sensitive areas. These findings indicate that local jurisdictions in coastal Texas have very little affinity toward using taxes for steering development to less hazards areas as well as preserving environmental sensitive areas. These results are consistent with some previous findings showing that more market-based mechanisms, whether as incentives or disincentives, are rarely used (Deyle et al., 1998; Olshansky & Kartez, 1998; Tang, 2008). However, it should be pointed out that some states, like

Florida, have made impact fees an important mechanism for not only financing mitigation activities, but for also funding a great variety of programs to help communities plan and implement hazard mitigation.

4.9 Local incentive tools

Nonfinancial incentive tools include a variety of programs whereby mitigation actions are promoted by offering developers, land owners, and even whole communities to obtain limited exemptions from regulations to which they would otherwise be subjected. For our purposes, these nonfinancial incentives have been broken down into two clusters, those that might be employed by local governments and those offered by the federal government. Table 4.9 present the data on the nonfinancial incentive tools that might be employed by local governments. These are the 1) transfer of development rights from environmentally sensitive and hazardous areas, 2) density bonuses, and 3) cluster development in environmentally sensitive and hazardous areas.

Table 4.9 Nonfinancial incentive tools

Nonfinancial Incentive tools		not at all	small extent	some extent	great extent	Total
Transfer of development rights	n	108	11	4	1	124
	%	87.1	8.9	3.2	0.8	100.0
Density bonus		113	7	4	0	124
		91.1	5.7	3.2	0.0	100.0
Clustered Development		111	6	6	1	124
		89.5	4.8	4.8	0.8	100.0

Unfortunately, the pattern that emerges from these data are quite similar to the findings above with respect to financial tools—on the whole very few coastal jurisdictions in Texas employ these methods. The findings are that 87.1% of the jurisdictions to not employ the transfer of development rights at all. Similarly, when it comes to density bonuses or cluster development options, both of which might be employed to entice developers to relocate development out of higher hazard or environmentally areas, 91.1% do not consider density bonuses and 89.5% do not offer cluster development options at all.

It is possible that one reason for the relatively low usage of these forms of incentives is, as Schwab et al. (2007) suggested, that they are often difficult for local governments to implement and for landowners to understand and accept. This is particularly the case with respect to transferring development rights, which requires local communities to identify areas they wish to protect, generally termed sending areas, and areas where they will allow more intensive development, termed receiving areas. It should be noted that these findings are, on the whole, *not* similar to previous studies that focused on plan evaluations and the adoption of incentive tools which suggests that local jurisdictions have adopted transfer of development rights, clustered development, and density bonuses in other coastal areas at somewhat higher rates (Davis, 2004; Hershman et al., 1999; Tang, 2008). For example, while not as frequently adopted as some other forms of land-use management, Godschalk and colleagues (1989) found that upwards of 20% of communities they surveyed employ development rights transfers. The rates for Texas are generally half those seen in previous research, yet these findings are examined for 2010-11, over twenty years later.

4.10 Federal incentive programs

Unlike the findings with respect to local incentives, many local jurisdictions employ federal incentive programs as part of the local policies that are important for coastal hazard mitigation. Table 4.10 displays the results for participation in the National Flood Insurance Program (NFIP) and the Community Rating System (CRS). Relatively speaking a remarkably high percentage of 63.7% of local jurisdictions along the Texas coast participated in NFIP to a very great extent with an additional 18.6% participating somewhat. While participation in CRS is more moderate, it still is substantial. In all, 37.1% of the jurisdictions participated in CRS extensively with additional percentages participating somewhat, 23.4%, or to a small extent, 10.5%. Overall, only a minority of the jurisdictions failed to participate in these programs at all.

Table 4.10 Federal incentive tools

Incentive tools	not at all	small extent	some extent	great extent	Total
Participation in the National Flood Insurance Program (NFIP) n	14	8	23	79	124
%	11.3	6.5	18.6	63.7	100.0
Participation in the FEMA community rating system (CRS)	36	13	29	46	124
	29.0	10.5	23.4	37.1	100.0

These findings clearly suggest much higher and more extensive participation in these two federally based incentive programs despite the fact that they can involve relatively stringent federal requirements in exchange for subsidized insurance rates. Specifically, both programs demand some level of federal mitigation policy compliance by local governments and yet, the incentives they also provide in access to flooding insurance and discounts are attractive enough to local governments and their citizens to insure more extensive participation, particularly when compared to local incentive programs.

4.11 Critical public and private facilities policies

Policies related to the placement of public facilities, public or private critical facilities and municipal service areas can keep buildings and infrastructure out of hazardous and sensitive environmental areas, as well as shape future development into safer areas. Table 4.11 displays the survey results for these policies. Even a cursory examination suggests that the percentages of local jurisdiction employing these policies are relatively low.

Table 4.11 Locating public and private facilities and service areas

Critical public and private facilities	not at all	small extent	some extent	great extent	Total
Requirements for locating public facilities and infrastructure n	67	21	24	12	124
%	54.0	16.9	19.4	9.7	100.0
Requirements for locating critical private facilities and infrastructure	67	24	22	11	124
	54.0	19.4	17.7	8.9	100.0
Using municipal service areas to limit development	82	22	14	6	124
	66.1	17.7	11.3	4.8	100.0

Very few jurisdictions made special requirements for locating public and private facilities and infrastructure out of harm’s way; indeed, 54.0% of the jurisdictions do not have requirements for locating such facilities and infrastructure out of environmentally sensitive or hazards areas. Only 9.7% have made extensive usage of public facility and infrastructure location policies and only 8.9% use location requirements extensively.

The least employed among these tools concerns using municipal service areas to limit development. As the data in Table 4.11 indicate, only 4.8% of local jurisdictions employ municipal service areas extensively. The vast majority of jurisdictions, 66.1% never use this strategy. On the whole, these findings are somewhat surprising, particularly with respect to the simple locating of public facilities and infrastructure. While there can certainly be issues in using municipal service areas to limit development, particularly in states not requiring or mandating comprehensive or general plans that can justify these limitations, simply insuring that public facilities and infrastructure are not located in environmentally sensitive or hazardous areas not only helps shape and guide development, but also helps reduce future losses and disruption of services in the case of future disasters. Neglecting these issues is surprising.

These findings were not generally consistent with what previous studies that found, in both the plan evaluation and the policy adoption literatures, that policies for locating critical public and private facilities out of hazardous and sensitive areas are commonly proposed land use tools (Deyle et al., 1998; Olashansky & Kartez, 1998). Moreover, the literature on actual policies enacted by coastal communities has found that locating public structures to reduce storm damage was practiced in nearly 46% of the jurisdictions surveyed (Beatley et al., 1994; Godschalk et al., 1989).

4.12 Public-private sector initiatives

There are many public and private sector initiatives that generally focus on preserving land in either its natural state, as in the case of wetlands or forest land, or preserving its current state as agricultural or otherwise open land. Informants were asked about the use of private sector tools like land trusts as well as public-private partnerships for land to preserve environmentally sensitive areas and reduce development in hazards areas. The findings are presented in Table 4.12, which shows that the vast majority of local jurisdictions do not make much use of these tools.

Table 4.12 Public-private sector initiatives

Initiatives		not at all	small extent	some extent	great extent	Total
Land trusts	n	102	9	9	4	124
	%	82.3	7.3	7.3	3.2	100.0
Public-private partnerships		99	13	9	3	124
		79.8	10.5	7.3	2.4	100.0

Almost no jurisdictions, 3.2% make extensive use of land trusts with an additional 7.3% using them somewhat. As can clearly be seen, the vast majority of jurisdictions, 82.3% do not employ land trusts at all. Similarly, 79.8% of local jurisdictions do not utilize public-private partnerships either. However, 10.5% have utilized them to a small extent, 7.3% to some extent, and 2.4% extensively. The use of land trust and public-private initiatives has increased since the 1990s in the United States and there is some indication of that happening, at least informally, in Texas. However, these data still suggest that not many jurisdictions are taking advantage of these approaches along the Texas Coast.

4.13 Employing professional for building mitigation

Hiring professionals for building mitigation is often needed, particularly when local agencies do not have the professional capacity to undertake technical assessments related to mitigation. Table 4.13 displays the findings with respect to hiring professional consultants such as planners, geologists and engineers to 1) identify suitable building sites in hazard prone areas, 2) develop special building techniques in hazard prone areas, and 3) conduct windstorm/roof inspection.

The data in Table 4.13 clearly suggest that most local jurisdictions do not employ professionals although there is some variation across the three activities for which such professionals might be hired. Relatively few jurisdictions hire geological or engineering consultants to determine suitable building sites in hazard prone areas. Specifically, 8.9% of the jurisdictions use these professionals extensively, 11.3% use them to some extent, and 21.8% use them occasionally, while 58.1% never employ them.

Table 4.13 Hiring professionals for building standards

Hiring professionals		not at all	small extent	some extent	great extent	Total
Identify suitable building sites	n	72	27	14	11	124
	%	58.1	21.8	11.3	8.9	100.0
Develop special building techniques		79	20	12	13	124
		63.7	16.1	9.7	10.5	100.0
Conduct windstorm/roof inspection		53	24	19	28	124
		42.7	19.4	15.3	22.6	100.0

Similarly, few jurisdictions (10.5%) extensively employ professionals to develop special building techniques in hazard prone areas. However, the majority of jurisdictions (63.7%) do not employ professionals for developing special building techniques or identifying suitable building sites.

A somewhat different pattern emerges when examining the use of professionals to conduct windstorm/roof inspection. A significant percentage (22.6%) of local jurisdictions employs professionals to conduct windstorm/ roof inspections extensively, 15.3% employ them somewhat and 19.4% employ them to a small extent. However, 42.7% of jurisdictions do not employ professionals at all for these types of inspections. The relatively higher use of professionals for wind and roof is likely due to the requirement of structures to be inspected by professionals to quality for Texas wind insurance coverage.

The findings clearly suggest that hiring professionals for windstorm and roof inspection is the most popular of these three mitigation activities when compared to hiring consultants for preventive activities such as developing special building techniques and the siting of structures in hazardous areas. It should also be noted that these results are consistent with previous studies on plan evaluation that have shown that relatively few coastal plans specified using geological and engineering consultants to identify suitable building techniques or to develop special building techniques (Tang, 2008). Consequently, the results for Texas may not be that unusual.

4.14 Summary of findings with respect to mitigation policies

On the whole, the findings clearly suggest that some policies are much more extensively employed than others, although the overall rates to which many are utilized appear to be quite low. A convenient method for quickly ascertaining the relative frequency of usage for each of these planning tools and strategies can be is to calculate and compare the average rating of each. Remembering that the response categories range from "0" indicating the tool/strategy is not employed at all to "3" indicating the method is employed extensively, the closer the average is to three, the more extensively the method is employed across coastal jurisdictions. Figure 4.1 presents a bar graph of the average ratings for each planning tool, where the size of the bar represents the average extent of usage. In addition, the planning tools have been rank ordered such that higher ranked and hence more extensively employed tools appear higher on the figure.

The top three planning tools are the only three planning tools have average ranks over two, suggesting that they are on the whole employed somewhat rather extensively across coastal jurisdictions in Texas. These three are: 1) participation in the national flood insurance program (2.35), 2) the use of in subdivision ordinances (2.34), and 3) flood standards for buildings/homes (2.30).

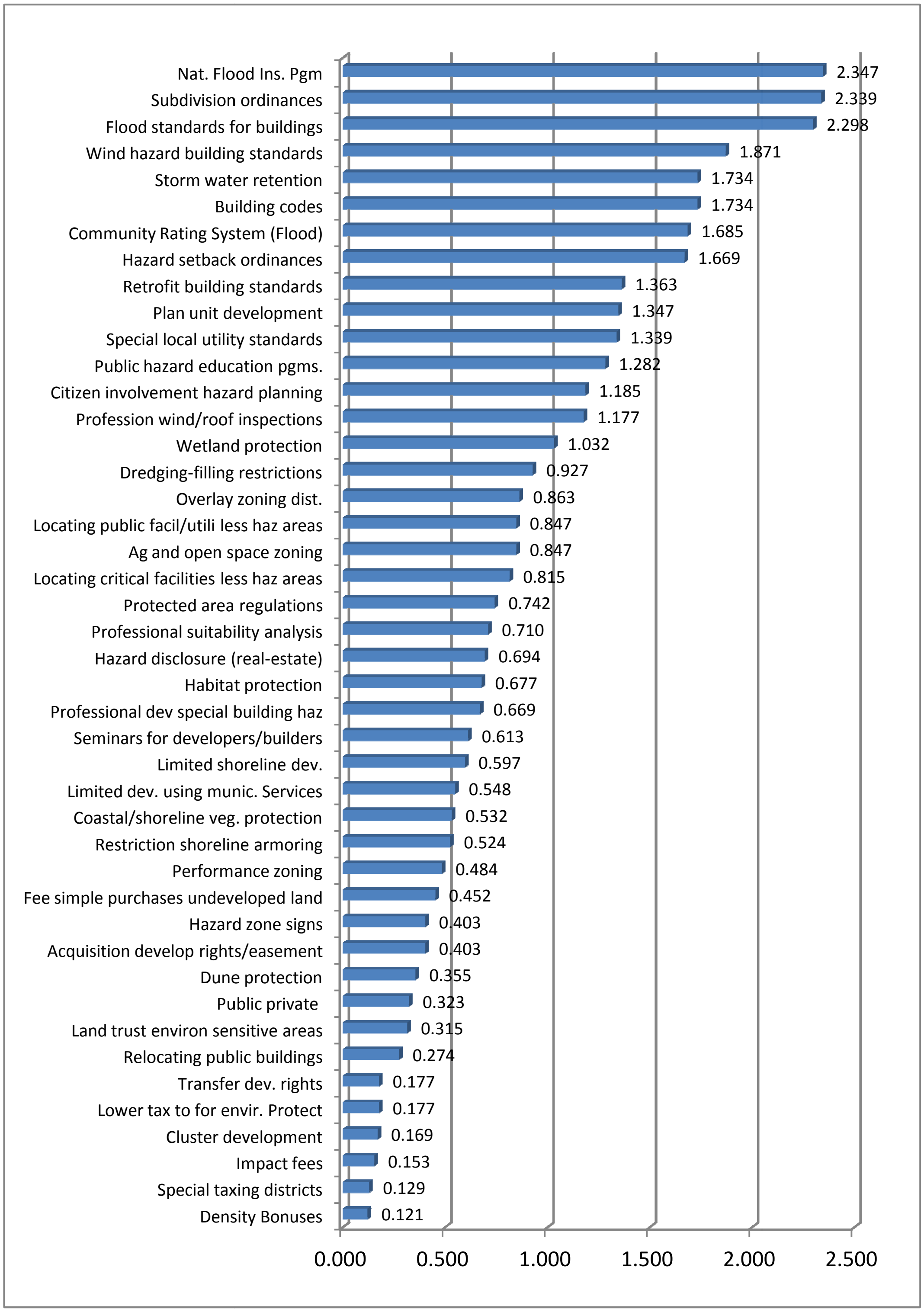

Figure 4.1 Ranking of land use and development regulations

It is interesting to note that two of the three are related to federal government policies. The NFIP is of course the federal flood insurance program and flood mitigation building standards are also driven by federal flood requirements to insure compliance with NFIP regulations. Subdivision ordinances are, as clearly seen is extensively employed by 64.5% of jurisdictions and to some extent by an additional 18.6% of jurisdictions; no other general development or land use regulation came close to these usage levels.

The next cluster consists of five tools that have significantly lower average ratings than the top three, but all have averages that fall between 1.87 and 1.67, suggesting they are employed to a small extent but clearly approaching the "to some extent" levels across jurisdictions. This cluster from high to low includes wind hazard building standards (1.87), storm water retention (1.73), building codes (1.73), the community rating system (1.69), and hazard setback ordinances (1.67). Three of these five are directly related to building code policies, the first being mandated by the State's Texas Wind Inspection Program for wind insurance coverage. Of the final two in this cluster, one is again associated with the federal government, the CRS, and the final one is a rather typical development/land use regulation – hazard setbacks.

When considering the top ten policies is use among coastal jurisdictions, five are related to building codes, two are federal incentive programs, and three are land use/development regulations. The three land-use policies were subdivision ordinances (2.34), hazard setbacks (1.67) and planned unit developments (1.35). Only about a third of the 44 policies/tool considered have averages of one or above, suggesting at least some usage among jurisdictions. The remaining 29 planning tools had very little used by coastal jurisdictions. By far the least utilized of these tools were density bonuses, special taxing districts, impact fees, cluster development, lower taxes for environmental protection, and transferring development rights. On the whole, these findings suggest a very limited tool set of land use planning policies are being employed by local jurisdictions along the Texas coast to promote hazard mitigation.

4.15 Comparing municipalities and counties hazard mitigation policy practices

As discussed earlier, many researchers have compared the utilization of different planning practices in states that do have planning mandates for reducing risk of hazards and those that lack such mandates. In addition, some studies have examined state and county level government policies, but few have examined differences between counties and municipalities in their planning practices. This section will provide a comparison between counties and cities in our sample of Texas coastal jurisdictions. This comparison is important because, as noted above, there are considerable variations in the extent to which cities and counties can enact policies to address hazard mitigation. Cities in Texas have much greater power than counties because they, subject to size limits and the adoption of a city charter, generally have "home rule" granting them eminent power to enact policies regarding land use and development regulations ranging from building codes to taxes. Counties, on the other hand, have much more limited power. However, as noted earlier, the state legislature has granted some counties additional powers to, for example, regulate development along inland shorelines and within subdivisions, and many counties exercise a good deal of influence on some elements of land use through flood plain management activities. Furthermore, after 2009, counties who so chose could establish and enforce building codes, and Harris County, home to the city of Houston, was rather quick to adopt this new power. In light of these differentials enabling cities to undertake a greater range of mitigation policy actions, it might be expected that they would rank higher than counties in the extensiveness in which they employ these policies.

Tables 4.14 and 4.15 present the average usage scores for each of the 44 policies discussed above. In addition, to examine overall differences between city and county with respect to each of the 12 types of hazard mitigation strategies and policies and in anticipation how more elaborate analyses will be undertaken, a simple index based on the average of the specific policies for each area was calculated and these were also compared. So, Tables 4.14 and 4.15 present the overall means for the entire sample, for municipalities and counties separately, and the difference between the latter two means. A *t*-test for the significance of the difference between the city and county means was computed for each of the 44 specific policies and for the 12 policy indices; if the difference between the respective means is statistically significant, the level of significance is indicted on the difference.

Table 4.14 County/city differences in mitigation policy/strategy usage, part 1

Hazard Mitigation Policy/strategy	Total sample	City	County	City and County Difference
Subdivision ordinances	2.34	2.49	1.77	0.72**
Planned unit development	1.35	1.46	0.92	0.54**
Overlay zoning districts	0.86	0.93	0.62	0.31
Ag and open space zoning	0.85	0.94	0.50	0.44^
Performance zoning	0.48	0.56	0.19	0.37^
Hazard setback ordinances	1.67	1.55	2.12	-0.56**
Storm water retention	1.73	1.79	1.54	0.25
Land use and development policies	1.33	1.39	1.09	0.29^
Limited shoreline development	0.60	0.54	0.81	-0.27
Restriction shoreline armoring	0.52	0.55	0.42	0.13
Dredging-filling restrictions	0.93	1.00	0.65	0.35
Dune protection	0.35	0.36	0.35	0.01
Coastal/shoreline veg. protection	0.53	0.51	0.62	-0.11
Shoreline regulations	0.59	0.59	0.57	0.02
Wetland protection	1.03	0.99	1.19	-0.20
Habitat protection	0.68	0.63	0.85	-0.21
Protected area regulations	0.74	0.72	0.81	-0.08
Natural resource protection	0.82	0.78	0.95	-0.17
Building codes	1.73	1.98	0.81	1.17**
Wind hazard building standards	1.87	2.12	0.92	1.20**
Flood standards for buildings	2.30	2.33	2.19	0.13
Retrofit building standards	1.36	1.44	1.08	0.36
Special local utility standards	1.34	1.55	0.54	1.01**
Building codes and standards	1.72	1.88	1.11	0.78**
Public hazard education programs	1.28	1.20	1.58	-0.37
Citizen involvement hazard planning	1.19	1.02	1.81	-0.79**
Seminars for developers/builders	0.61	0.53	0.92	-0.39*
Hazard disclosure (real-estate)	0.69	0.58	1.12	-0.53*
Hazard zone signs	0.40	0.34	0.65	-0.32^
Hazard information & awareness programs	0.84	0.73	1.22	-0.48**
Fee simple purchases undeveloped land	0.45	0.42	0.58	-0.16
Acquisition develop rights/easement	0.40	0.41	0.38	0.02
Relocating public buildings	0.27	0.23	0.42	-0.19
Property acquisition programs	0.38	0.35	0.46	-0.11

** = $p \leq .01$; * = $p \leq .05$; ^ = $p \leq .10$; all tests two-tailed

Table 4.15 County/city differences in mitigation policy/strategy usage, part 2

Hazard Mitigation Policy/strategy	Total sample	City	City and County County	Difference
Lower taxes for environmental protect	0.18	0.19	0.12	0.08
Special taxing districts	0.13	0.15	0.04	0.11
Impact fees	0.15	0.15	0.15	0.00
Financial tools	0.15	0.17	0.10	0.06
Transfer development rights	0.18	0.17	0.19	-0.02
Density Bonuses	0.12	0.11	0.15	-0.04
Cluster development	0.17	0.18	0.12	0.07
Local incentive tools	0.16	0.16	0.15	0.00
National flood insurance program	2.35	2.30	2.54	-0.24
Community rating system (Flood)	1.69	1.61	1.96	-0.35
Federal incentive tools	2.02	1.95	2.25	-0.30
Locating public facilities/utilities in less haz areas	0.85	0.90	0.65	0.24
Locating critical facilities less hazardous areas	0.81	0.87	0.62	0.25
Municipal service areas to limit development	0.55	0.60	0.35	0.26
Critical public and private facilities	0.74	0.79	0.54	0.25
Land trust environ sensitive areas	0.31	0.23	0.62	-0.38*
Public-private partnerships	0.32	0.29	0.46	-0.18
Public/Private initiatives	0.32	0.26	0.54	-0.28^
Professional for special building techniques	0.67	0.64	0.77	-0.13
Profession wind/roof inspections	1.18	1.30	0.73	0.57*
Professional suitability analysis	0.71	0.69	0.77	-0.08
Hiring professional for building standards	0.85	0.88	0.76	0.12

** = $p \leq .01$; * = $p \leq .05$; ^ = $p \leq .10$; all test two-tailed

On the whole, and perhaps somewhat surprising at first blush, when scanning the results for both tables, is the general finding that there simply are not that many statistically significant differences when comparing cities and counties. Of the 12 sets of comparisons, there are no statistically significant differences between cities and counties for seven different sets. Specifically, there are no significant differences found between cities and counties when comparing the specific and combined strategies and policies with respect to shoreline regulations, natural resource protection, property acquisition programs, financial tools, local incentives, federal incentives, or placement of public and private critical facilities and utilities.

Simply stated, there appear to be no real differences between cities and counties with respect to their utilization of these types of mitigation programs or strategies. The major statistically significant differences between cities and counties occur with respect to land use and development policies, building codes and standards, hazard information and awareness programs. There are also some differences between public/private initiatives and use of professionals.

Focusing first on land use and development regulations there are highly significant differences between counties and cities with respect to subdivision ordinances, planned unit development and hazard setbacks, but the pattern is not consistent. While cities are more likely to employ subdivision ordinances and planned unit developments, surprisingly, counties are more likely to employ hazard setbacks. Cities are also more likely to employ agricultural or open space and performance based zoning, but the differences are only marginally significant. Finally, given the inconsistent patterns, it is perhaps somewhat surprising that there is a marginally significant difference between cities and counties with respect to the usage of land use and development policies as assessed by the combined index.

The differences with respect to building codes are perhaps not surprising, given that cities generally have much greater capacity to enact building codes and standards. Cities are much more likely to more extensively employ building codes, wind standards, and special utility standards. Furthermore, with respect to the combined index, cities show higher overall utilization of building codes and standards. It is interesting to note that the mean usage scores for flood standards are quite similar for cities and counties. This is one area in which both types of jurisdictions have similar legal status.

Perhaps one of the more interesting findings is with respect to hazard information and awareness programs. There are significant differences with respect to citizen involvement in hazard mitigation planning, seminars for developers/builders, hazard disclosure statements, and hazard zone signs, although the latter is only marginally significant,. Counties, not cities, make more extensive usage of these strategies. In addition, counties also score significantly higher on the combined hazard information and awareness program index. Clearly, counties are more extensively employing these types of strategies.

Only a few comparisons are statistically significant in Table 4.15, but they are quite interesting. First, counties are making more extensive use of land trusts to protect environmentally sensitive and hazardous areas. Furthermore, counties are also making more usage of public-private initiatives as a whole, although the difference is only marginally significant. However, cities are making more extensive usage of professionals for wind/roof inspections.

It is interesting to combine these overall findings. On the one hand, cities are more extensively employing building code regulations and various forms of land development regulations while, on the other hand, counties are more extensively using information dissemination strategies and public-private initiatives. These findings suggest that cities, who generally have home rule, are utilizing more extensively the two powerful sets of strategies they have been granted by the state legislature—building codes and development regulations. Counties on the other hand, with much more limited powers, depend more extensively on hazard information and awareness programs in the hope that these will stimulate voluntary mitigation adjustments. Counties also depend more on public/private initiatives in the form of land trusts to help preserve and enhance mitigation through natural resource protection. These findings suggest different types of jurisdictions are utilizing strategies open to them to promote hazard mitigation. However, even with that observation, it should also be noted that overall the mean values are consistently low for many of these strategies, suggesting that jurisdictions of both types have considerable latitude for increasing how extensively they employ these policies and strategies.

Interestingly, it must again be pointed out that there were no statistically significant differences between counties and municipalities in regards to seven of the 12 policy sets. When focusing on the combined index scores, city mean scores for shoreline regulations, local incentives tools, financial tools, critical public-private facilities relocation, and professional for building mitigation policies are higher than county scores, but the differences are not statistically significant. Similarly, county mean scores for natural resource protection and property acquisition programs are higher than those for municipalities, but they too are not statistically significant. The one additional comparison that is perhaps worth noting is the summary index for federal incentives programs because the means for both counties (2.25) and cities (1.95) for these programs are higher than those for any of the other programs. This indicates that these federal incentive programs are among the most extensively employed mitigation programs among coastal jurisdictions. On the whole, both types of jurisdictions, particularly counties, are extensively participating in the National Flood Insurance Program (NFIP) and the Community Rating System (CRS) but not other forms of mitigation programs and policies. Again, coastal jurisdictions are not employing a full portfolio of possible non-structural hazard mitigation policies and strategies.

Previous studies suggest that the type of jurisdiction, county versus city, can influence local coastal zone land use planning and may lead to varied coastal planning outcome (Norton, 2005b; Tang, 2008). These data also suggest differences between cities and counties in Texas when utilizing hazard mitigation policies. In particular, cities make stronger and more extensive efforts in using development regulations and building standards, while counties tend to make more extensive use of programs that either require greater reliance on private sector individuals or groups working with the public or, alternatively, programs that stimulate voluntary hazard mitigation adjustments through hazard information and awareness programs. However, the findings also demonstrate that Texas coastal cities and counties are making less use of policies related to shoreline regulations, natural resource protection, local and incentives tools, financial tools, critical public-private facilities relocation, property acquisition, and professional for building mitigation. The exception to this rule is related to the extensive use of federal incentive programs. Even more sobering is the observation that, as can be seen from the table, the mean scores for many of the 44 planning policies/tools for both types of jurisdictions are very low. They are often less, sometimes substantially less, than 1.

These low averages indicate very low usage of a most hazard mitigation tools by Texas coastal jurisdictions.

4.16 Summary

This chapter has examined land use and development practices for the entire sample and the differences between cities and counties in using these policies to enhance hazard mitigation in coastal areas. The following is a summary of the findings. First, building codes and standards, federal incentive programs, and a limited number of development regulations (subdivision ordinances and setbacks) were the most extensively used hazard mitigation policies. Second, financial tools and policies that make use of bonuses, taxes and fees are the least extensively employed by the local jurisdictions. These low levels of usage are particularly evident with respect to local incentives tools and property acquisition programs. Third, there are statistically significant differences between cities and counties in employing building standards, development regulations, information dissemination and public-private initiatives. While counties more extensively employ the latter two programs, cities are more likely to employ the former two. These findings suggest that the type of jurisdiction and its powers, structures, and functions do influence the types of hazard mitigation policies and strategies practices at the local level.

Overall, coastal communities in Texas are employing a very limited set of land use and development regulations that the literature has suggested are important for hazard mitigation. Although previous studies on land use planning or comprehensive planning tools have found that some communities are employing a robust set of land use tools and development regulations that are commonly practiced for hazard planning (Deyle et al., 1998; Olashansky & Kartez, 1998), such is not the case in Texas. As suggested by Slotterback (2008, p. 546) “the implementation of planning documents and their associated objectives and strategies, including those related to environmental review, remains a challenge for planners”. This certainly is the case for planners throughout coastal Texas.

CHAPTER V

CONCEPTUAL FRAMEWORK, MEASUREMENT AND RESEARCH HYPOTHESES

5.1 Conceptual framework

The objective of this chapter is to more fully articulate a framework, derived from the literature review presented in Chapter II, specifying a model of factors that are identified by the literature to influence the extent to which coastal jurisdictions utilize a variety of non-structural hazard mitigation policies and strategies along with the measurement of variables to be included in the model. The discussion in Chapter II has already outlined the essential elements of the model. That chapter discussed 12 different types of non-structural mitigation polices suggested by the planning literature to be potentially effective in addressing hazard mitigation, along with examples of each. That chapter also discussed key factors that previous research suggests are important determinants of the extent to which jurisdictions employ these strategies by either implementing them or including them as part of their comprehensive, general, or mitigation planning efforts. Central among these factors were a community's capacity and commitment, along with a host of other factors that are also thought to be important. The current chapter will more formally present the model, discuss the measurement of the variables to be included in it, and restate the basic research questions to be investigated as a series of formal research hypotheses regarding the anticipated effects of the key independent variables on the dependent variable(s).

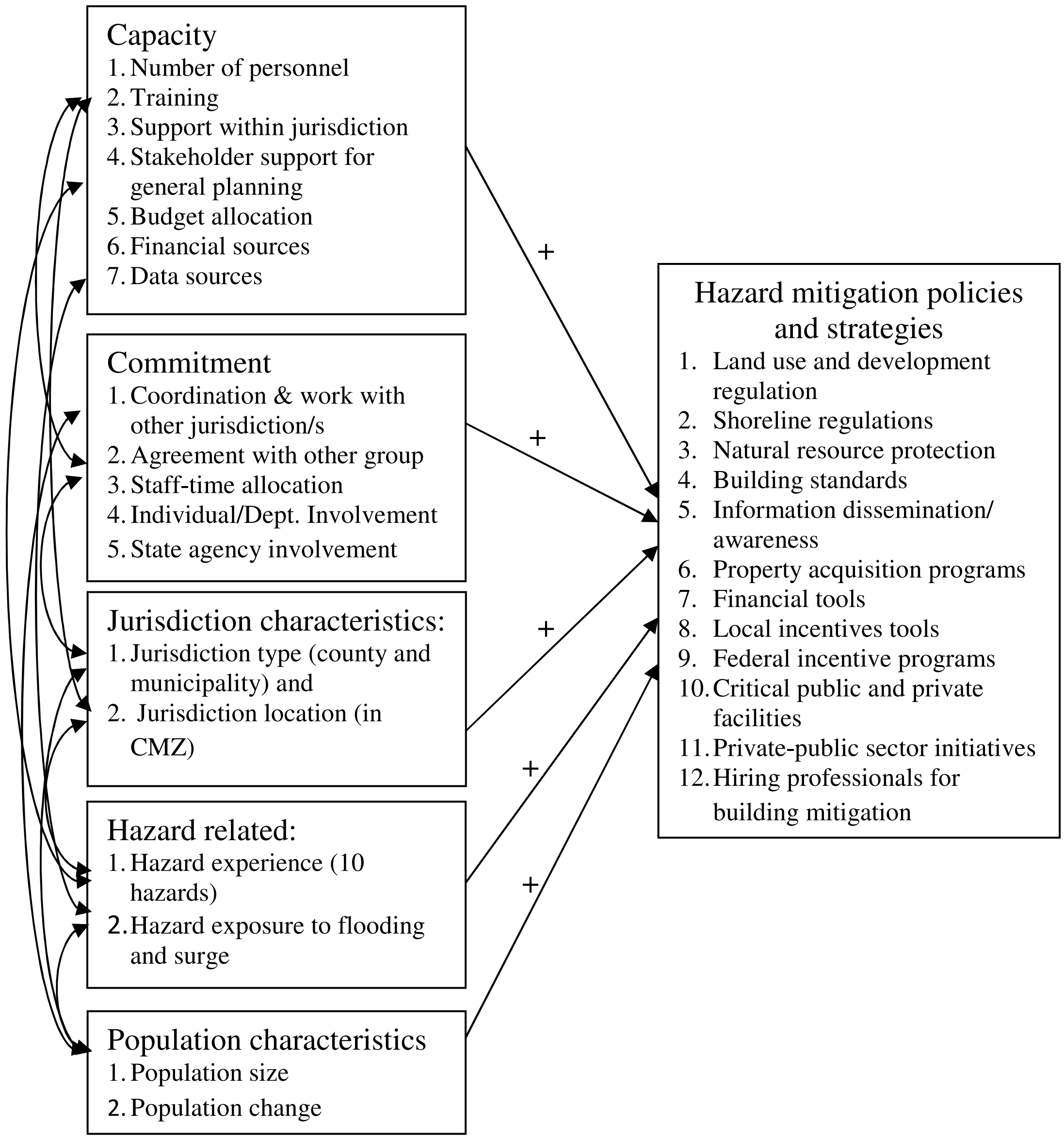

Figure 5.1 Conceptual framework

Figure 5.1 depicts the model that will be tested in this research by specifying the relationships among the relevant variables. In anticipation of the discussion of measurement, it also displays additional information regarding the measurement of the dependent variable and the two key independent variables, capacity and commitment. Finally, it provides information regarding additional control variables to be included.

As illustrated, hazard mitigation strategies and policies, or more specifically, the extent to which these policies are employed by jurisdictions will be the dependent variable of this model. Actually, as will be more completely discussed below, 12 different indices assessing the extent to which specific categories of policy/strategy are being employed by jurisdictions, along with a combined overall hazard mitigation policy index will serve as dependent variables. The key independent variables are measures of jurisdictional capacity and commitment for engaging in hazard mitigation. Each box lists the different indicators that will be employed to measure each concept – there are seven for capacity and five for commitment. There are also three sets of control variable that will be employed and these are related to jurisdictional status characteristics (two variables), hazard experience and exposure (two variables), and population characteristics (two variables). While more formal hypotheses will be offered after discussing the measurement of these sets of indices and variables, as can be seen from Figure 5.1, the general expectations are that capacity and commitment along with control variables (measures of jurisdiction status, hazard experience, and population characteristics) should have positive effects on the extent to which jurisdictions employ hazard mitigation policies and strategies.

5.2 Measurement

This section will address the measurement of the dependent and independent variables. The latter will focus on the key variables, capacity and commitment, but also provide information on how each of the control variables are operationalized. In the case of the dependent and key independent variables, a set of indicators will be employed to develop indices for key conceptual dimensions and these in turn will be combined into more comprehensive measures of the theoretical concept. With respect to all measures, the following sections will first discuss the questionnaire items that gathered specific data that will be employed and then, in the case of measures requiring index construction, a reliability analysis will be performed. This reliability analysis will focus on the internal consistency among the indicators and will be assessed employing a correlation analysis and Cronbach's alpha (Babbie, 2005; Carmines & Zeller, 1979; Norusis, 2005).

In undertaking this analysis, the goal is not simply to select the set of indictors that maximizes the empirically assessed internal consistency (i.e., maximum inter-item correlations and alphas), but rather to provide a general assessment of the degree to which the measures hold together in a consistent fashion. Given the nature of the goals here, to develop a set of indices for the extent to which jurisdictions utilize different sets of hazard mitigation policies and highly complex concepts like capacity and commitment, the focus is on the interplay between theory and empirical relationships. There is not a theoretical nor empirical reason to suggest that jurisdictions adopt different sets of mitigation tools as whole blocks nor are there theoretical reasons to, a priori, expect that jurisdictions must always insure that the multiple dimensions of commitment (i.e., insuring political buy-in from all stakeholders, mutual aid agreements across all possible partners, etc.) or capacity (i.e., budgets, technical knowledge and training, personnel, etc.) are available. As a consequence, measures that are theoretically related might not always be empirically correlated, particularly among complex multi-dimensional phenomena like these concepts. Nevertheless, it is clearly expected that there should be relational affinity among the measures proposed. Hence, in undertaking this analysis, the goal is to maximize the internal consistency of the indices while simultaneously seeking to insure that theoretically important dimensions are not ignored or compromised.

5.2.1 Dependent variables: the usage of hazard mitigation policies and strategies

Chapter II provided a systematic discussion of the variety of different non-structural hazard mitigation policies and strategies and gave specific examples of policies and strategies generally discussed in the planning and hazard mitigation literature. Specifically, based on the literature 12 different categories or types of strategies were identified; these were: 1) land use and development regulation, 2) shoreline regulations, 3) natural resource protection, 4) building standards, 5) information dissemination/awareness programs, 6) property acquisition programs, 7) local incentives tools, 8) federal incentive programs, 9) financial tools, 10) critical public and private facilities policies, 11) private-public sector initiatives and 12) hiring professionals for building mitigation. Chapter IV introduced more detailed information regarding the specific mitigation policies and strategies associate with each of the 12 types for which information on the extent to which each is employed by coastal jurisdictions was collected from jurisdictional informants. In addition to a detailed discussion of the actual prevalence and usage of these policies among coastal jurisdictions, Chapter IV also introduced the notion of creating a simple index by creating an average usage score for each set of specific policies/strategies associated with each of the 12 types. As was mentioned above, these individual usage indices will serve as dependent variables in the multivariate analysis portrayed in Figure 5.1. In addition, as will be addressed below, these 12 indices will in turn be combined to form a single index assessing the overall pattern of usage across these were policy dimensions. Following, it will be described each index of dependent variable and its indicators.

5.2.1.1 Development regulations and land use tools

As discussed in Chapter II, there are many different development regulations and land use policies that communities have utilized to steer development away from hazardous or environmental sensitive areas and promote more responsible and appropriate development in areas with lower hazard impact risks (Beatley et al., 2002; Daniels & Daniels, 2003; Godschalk et al., 1999; Schwab et al., 1998). For this study, data was collected on the extent to which jurisdictions used: 1) residential subdivision ordinances, 2) planned unit developments, 3) special overlay zoning districts, 4) agricultural or open space zoning, 5) performance zoning, 6) hazard setback ordinance, and 7) storm water retention requirements. Table 5.1 displays the inter-item correlations among these seven policies.

Table 5.1 Inter-item correlations among development and land use regulations

	Development land use regulations	1	2	3	4	5	6	7
1	Residential sub-division ordinance							
2	Planned unit development	.45*						
3	Overlay zoning	.32*	.47*					
4	Agricultural-open space zoning	.26*	.41*	.42*				
5	Performance zoning	.27*	.54*	.48*	.63*			
6	Hazard setback	.10	.26*	.10	.15	.25*		
7	Storm water retention	.32*	.47*	.25*	.25*	.34*	.18*	

Note: * = $p \leq .05$ (2-tailed); $n = 124$

As can be seen in the table, all correlations are positive and most are statistically significant. The highest intercorrelation is between performance based and agricultural-open space zoning (.63) and the lowest is between storm water retention and hazard setbacks (.18). The weakest variable in this group is clearly the hazard setback measure, which has only three significant intercorrelations with other measures. It does have a positive and significant correlations with planned unit development, performance based zoning, and storm water retention restrictions. Overall the average inter-correlation for this set of measures is .33, which yields a Cronbach's alpha of .78. A case could be made for dropping hazard setbacks because deleting this variable has virtually no effect on alpha. However, hazard setbacks is one of two measures that are clearly directly addressing hazard mitigation; hence, since the gains are limited and the inclusion of hazard setbacks better captures a range of mitigation tools, it was decided to retain it in this set.

5.2.1.2 Shoreline regulations

Shoreline regulations focus on limiting or restricting the types of activities that take place along coastal, lake and riverine shorelines. The survey collected information related to the extent to which local jurisdictions have implemented or enacted 1) limitation on shoreline development to water-dependent uses, 2) restriction on shoreline armoring and 3) restriction on dredging and filling as well as introduced 4) dune protection and 5) coastal vegetation protection.

Table 5.2 Inter-item correlations among shoreline regulations indicators

	Shoreline Regulations	1	2	3	4	5
1	Limit shoreline-water dependent uses					
2	Restriction on armoring	.78*				
3	Restriction on dredging	.42*	.48*			
4	Dune protection	.59*	.73*	.30*	1	
5	Coastal vegetation protection	.67*	.73*	.32*	.76*	1

Note: * $p \leq .05$ (2-tailed); $n = 124$

Table 5.2 provides the intercorrelations among the measures associated with shoreline protection and regulation. All of these correlations are positive and statistically significant, with the highest correlation being between limiting shoreline development to water dependent uses and restrictions on shoreline armoring (.78) and the weakest between dune protection and restrictions on dredging (.30). The weak correlation here is probably due to the fact that dredging is generally not an issue on shorelines where dunes are more likely to be in place. Indeed, of these measures, restrictions on dredging consistently displays lower inter-item correlations with other measures. The average intercorrelation among these five measures is .58, yielding a rather respectable alpha of .87. Dropping the dredging item would boost the average inter-correlation and increase the alpha to .91. Yet again, in the interest of capturing a fuller range of shoreline protection techniques, the dredging item will be retained.

5.2.1.3 Natural resource preservation and protection

Three items are associated with natural resource preservation and protection which are generally aimed at reducing development in areas that not only might be more hazardous, but also have the possibility of providing mitigation services as is the case with wetlands. These policies are: 1) wetland protection, 2) habitat protection/restoration, and 3) protected areas preservation. Table 5.3 displays the intercorrelations among these measures.

Table 5.3 Inter-item correlations among natural resource protection items

	Natural resource protection	1	2	3
1	Wetlands protection			
2	Habitat protection	.65*		
3	Protected areas	.76*	.84*	

Note: * $p \leq .05$ (2-tailed); $n = 124$

These intercorrelations are all positive, statistically significant and quite strong, ranging from a high of .84 between habitat protection and preserving protected areas to a low of .65 between wetland protection and habitat protection. The average inter-item correlation among these three items was .75, yielding an alpha of .90. Yet again, however, there are subtle variations among these indicators, in that wetland protection’s inter-item correlations are slightly lower. Indeed, dropping the wetland measure would yield a slightly higher alpha of .91, but wetland preservation is a highly discussed and effective mitigation strategy so it would be questionable to drop it.

5.2.1.4 Building standards

As seen in Chapter IV, building codes and standards were some of the more extensively employed mitigation strategies employed by Texas coastal jurisdictions. However, there were also significant differences among the items making up this category. The indicators of building standards are: 1) building codes, 2) wind hazard resistance for new homes, 3) flood standards for new homes, 4) retrofit for existing building, and 5) special utility codes. Table 5.4 provides the inter-item correlations for these measures.

Table 5.4 Inter-item correlations among building code and standards measures

	Building standards	1	2	3	4	5
1	Building code					
2	Wind hazard resistance for new home	.45*				
3	Flood standards for new homes	.25*	.53*			
4	Retrofit for existing buildings	.34*	.58*	.61*		
5	Special utility codes	.36*	.52*	.56*	.61*	

Note: * = $p \leq .05$ (2-tailed); $n = 124$

The heterogeneities seen in Chapter IV, with respect to the prevalence of usage levels for these measures is clearly reflected in this correlation matrix. While all correlations are significant and positive, the intercorrelations among the more specialized building standards (wind, flood, retrofit and utilities) are consistently stronger when compared to the intercorrelations between these items and building codes. Adopting and utilizing more recently established building codes does not always follow from the adoption of more specialized building codes. The average inter-item correlation for the set of five measures is .48, yielding an alpha of .82. Dropping the building code measure would increase the average inter-item correlation among the remaining four measures to .57 and yield a slightly higher alpha of .84. However, it would make little sense to have an index of building standards that does not include base level building codes employed by a jurisdiction; hence, all five measures will be retained in this index.

5.2.1.5 Hazard information dissemination strategies and awareness programs

Hazard information and awareness programs were also, relatively speaking, quite prevalent among jurisdictions, particularly among counties, which generally displayed more extensive usage than cities. The five different programs or strategies considered were: 1) public education for hazard mitigation, 2) citizen involvement in hazard mitigation planning, 3) seminar on hazard mitigation practices for developers and builders, 4) hazard disclosure, and 5) hazard zone signage. Table 5.5 displays the intercorrelations among these measures.

Table 5.5 Inter-item correlations among information dissemination indicators

	Information dissemination	1	2	3	4	5
1	Public education for hazard mitigation					
2	Citizen involvement in hazard mitigation planning	.68*				
3	Hazard workshops for developers and builders	.60*	.64*			
4	Hazard disclosure statements	.43*	.48*	.49*		
5	Hazard zone signage	.41*	.47*	.41*	.60*	

Note: * $p \leq .05$ (2-tailed); $n = 124$

While there are some variations in the strength of the correlations, these measures generally have moderate to strong positive correlations and all are statistically significant. The first three measures, public education programs, citizen involvement in mitigation planning, and hazard workshops, seem to be slightly more strongly intercorrelated and the final two, hazard disclosure statements and hazard zone signage also seem to be slightly more strongly inter-correlated with each other. As a consequence, dropping either of the two final measures, actually increases the average inter-item correlations among the remaining three, however the average inter-correlation among all five is .52, which yields the highest alpha for any combination of the set of measures at .84.

5.2.1.6 Property acquisition programs

As noted in Chapter II, property acquisition can effectively insure that development does not occur in high hazard areas or in environmentally sensitive areas, however such programs can be expensive and can result in legal challenges. The acquisition programs are: 1) fee simple purchase of undeveloped lands in environmentally sensitive/hazardous areas, 2) acquisition of development rights or easements in environmentally sensitive/hazardous areas, and 3) relocating existing buildings from environmentally sensitive/hazardous areas. Table 5.6 displays the inter-correlations among these measures.

Table 5.6 Inter-item correlations among property acquisition indicators

	Property acquisition programs	1	2	3
1	Fee simple purchase	1		
2	Acquisition of development rights or easements	.65*	1	
3	Relocating existing buildings	.42*	.65*	1

Note: * $p \leq .05$ (2-tailed); $n = 124$

All of these measures have moderate positive and statistically significant correlations. While there are some variations among these correlations, and the overall average intercorrelation can be increased by dropping any one of these measures, the average intercorrelation among these three measures is .58, which yields an alpha of .80.

5.2.1.7 Financial tools

Financial tools can be both incentives as well as disincentives to encourage land owners and developers to preserve open areas or maintain land uses that the community would like to see preserved, as well as mechanisms to offset the public costs of development. As discussed in Chapter IV this set displayed some of the lowest usage rates among coastal jurisdictions. This research considered three policies: 1) lower tax rates for preserving specific coastal areas as open space or limited development intensity, 2) special tax assessments for specific coastal areas or desired land-uses and 3) impact fees for the development of specific coastal areas. Table 5.7 displays the inter-correlations among these items.

Table 5.7 Inter-item correlations among financial tools

	Financial tools	1	2	3
1	Lower tax rates	1		
2	Special tax assessment	.64*	1	
3	Impact fees or special assessments	.52*	.81*	1

Note: * $p \leq .05$ (2-tailed); $n = 124$

All of these measures have moderate positive and statistically significant correlations. While there are some variations among these correlations, and the overall average intercorrelation can be increased by dropping any one of these measures, the average intercorrelation among these three measures is .58, which yields an alpha of .80.

5.2.1.8 Local incentives tools

Local incentive tools are mechanisms adopted by jurisdictions to provide incentives to landowners and developers to modify the nature of their development objectives to enhance mitigation and ecosystem preservation. The three local incentive programs are: 1) transfer development rights from environmentally sensitive and hazardous areas, 2) density bonus, and 3) cluster development in the environmentally sensitive and hazardous areas. Table 5.8 displays the correlations among these items.

Table 5.8 Inter-item correlations among local incentives indicators

	Local Incentives tools	1	2	3
1	Transfer of development rights	1		
2	Density bonuses	.63*	1	
3	Clustered development	.45*	.71*	1

Note: * = $p \leq .05$ (2-tailed); $n = 124$

All of the measures associated with local incentive programs are significantly and positively correlated. The strongest correlation is between cluster development and density bonuses, with the weakest between cluster development and the transfer of development rights (TDR). The average inter-item correlation among these three measures is .60, yielding a Cronbach's alpha of .82. If TDR was dropped, there would be a slight gain in the alpha measure to .83, but again, in the interest of capturing a fuller range of locally instituted incentive programs, the full set of three measures was maintained.

5.2.1.9 Federal incentives tools

As presented in Chapter IV, federal incentive programs were by far the most widely employed mitigation programs or policies adopted among jurisdictions along the Texas coast. The two federal incentive programs included: 1) participation in the National Flood Insurance Program (NFIP) and 2) the Community Rating System (CRS). The correlation between these two measures was significant and positive, but only moderately strong at .38, which yields a reliability coefficient of only .55. The relatively low correlation between these programs reflects that fact that it takes considerably more effort for a jurisdiction to participate in the CRS program than it does to simply participate in the NFIP. The reliability coefficient for this index is by far the smallest discussed thus far.

5.2.1.10 Critical public and private facilities requirements

Critical public and private facilities requirements can be useful for directing development away from potential impacts of hazards. This research considered three policies including: 1) requirements for locating public facilities and infrastructure in less environmentally sensitive/hazardous areas, 2) requirements for locating critical private facilities and infrastructure in less environmentally sensitive/hazardous areas, and 3) using municipal service areas to limit development in environmentally sensitive/hazardous areas.

Table 5.9 Inter-item correlations among critical private and public facility regulations

	Critical private and public facilities	1	2	3
1	Requirements for locating critical public facilities and infrastructure			
2	Requirements for locating critical private facilities and infrastructure	.87*		
3	Using municipal service areas to limit development	.61*	.66*	

Note: * $p \leq .05$ (2-tailed); $n = 124$

The correlations among these items are all statistically significant and strongly positive. The highest correlation (.87) is between the locating of public and private critical facilities and infrastructure in non-hazardous areas. Meanwhile, the correlations between these measures and the remaining measure, using municipal service areas to limit development, are between .61 and .66. The overall average inter-item correlation among these three measures is .71, which produces an alpha of .88. Not, surprisingly, given the relationship structure, dropping the final measure would increase the alpha slightly to .93.

5.2.1.11 Private and public sector initiatives

This research considered two types of private-public sector initiatives: 1) land trust and 2) public-private partnerships. There is a relatively strong and statistically significant correlation between these two variables of .69. This relatively strong correlation between these two variables yields a reliability coefficient of .82.

5.2.1.12 Employing professionals for building mitigation

Hiring professionals such as geologists, flood plain managers and engineers can be important for jurisdictions without sufficient personal or technical expertise to address and improve hazard mitigation. This strategy involves using professional consultants to 1) identify suitable building sites, 2) develop special building techniques in hazard prone areas, and 3) conduct windstorm/roof inspection. Of the three, hiring professionals for wind/roof inspections was more widespread and extensively used, particularly among municipalities in the coastal region. Table 5.10 presents the inter-correlations among these three measures.

Table 5.10 Inter-item correlations among hiring of professional for addressing mitigation issues

	Employed geologists, engineers, and other professionals	1	2	3
1	Identify suitable building sites			
2	Develop special building techniques	.79*		
3	Conduct windstorm/roof inspection	.49*	0.48*	

Note: * $p \leq .05$ (2-tailed); $n = 124$

These three measures are also positively correlated, with moderate to strong statistically significant correlations. The strongest relationship is between the two measures for hiring professionals for siting buildings and developing special building techniques, while the correlations between hiring professionals to conduct wind inspections and the other two measures are more in the moderate range. The average intercorrelation among these three measures is .59, which yields an alpha of .81. This alpha can be increased to .88 if the most frequently and extensively used of these strategies, hiring professional to conduct wind inspections, is dropped. However, the inclusion of this measure provides important information in assessing the extent to which coastal jurisdictions are employing these three strategies, hence all three will be retained for the index.

5.2.1.13 A combined hazard mitigation policy usage index

When considering combining all the data on how extensively the various mitigation policies and strategies are employed by local jurisdictions to address mitigation issues, a number of factors need to be considered. First, one potential solution might be to simply combine the 44 different measures by either adding or averaging all measures. This is easily possible, because all 44 measures have been assessed using a common metric. However, as seen above and in Chapter IV, there are variations in the numbers of specific strategies, ranging from seven to two, across the 12 mitigation policy sets considered. There are, for example, seven different strategies considered under land use and development regulations however there were only two considered under federal incentive programs and public-private initiatives. Simply combining the 44 measures would in effect weight those types of mitigation strategies with higher numbers of specific examples more heavily than others. This may well be reasonable under some schemes, however there is little guidance in the literature to justify such a differential weighting scheme. As a consequence, a combined index was created by simply averaging the 12 different indices described above. The resulting measure represents the average extent to which mitigation policies/strategies are being employed by a jurisdiction across the 12 mitigation policy types.

Table 5.11 Correlations among 12 indices of land use tools and development regulations

		1	2	3	4	5	6	7	8	9	10	11	12
1	Development regulations												
2	Shoreline regulations	.32*											
3	Natural resource protection	.47*	.64*										
4	Building standards	.53*	.31*	.37*									
5	Information dissemination	.34*	.35*	.42*	.32*								
6	Local incentives	.50*	.42*	.40*	.29*	.40*							
7	Federal incentives	.27*	*.13*	.22	.22*	.46*	*.14*						
8	Financial tools	.39*	.42*	.34*	*.17*	.39*	.69*	.18					
9	Property Acquisition	.42*	.40*	.37*	.27*	.52*	.62*	.29*	.70*				
10	Critical facilities	.52*	.29*	.36*	.40*	.57*	.46*	.23*	.49*	.55*			
11	Public private initiatives	.29*	.33*	.26*	*.14*	.60*	.42*	.27*	.57*	.67*	.47*		
12	Hiring professionals	.43*	.38*	.54*	.46*	.46*	.36*	.21*	.31*	.42*	.42*	.29*	

Note: * = $p \leq .05$ (2-tailed); $n = 124$

Table 5.11 shows the inter-item correlations among the 12 mitigation policy usage indices. Of the 66 correlations among the 12 indices, 62 are positive and statistically significant. The strongest correlation (.70) is between financial tools and property acquisition programs, although quite a number are in the .50 or above range, suggesting relatively strong positive correlations among the indices. The four non-significant correlations are associated with federal incentive programs and building codes and standards.

Specifically, federal incentive program usage is not significantly correlated with the extent to which shoreline regulations and local incentive employed. Similarly, the extensiveness to which building codes/standards are employed is not related to financial or public-private initiative program usage. With the exception of these four correlations, the remaining 62 correlations reflect an expected overall positive association among these indices. The average intercorrelation among these 12 indices is .39, yielding a strong alpha of .89. These finding suggest that the combined index will consistently capture the extensiveness to which local jurisdictions are employing hazard mitigation policies and strategies.

Before leaving the discussion of the indices that will be employed to assess the extent to which jurisdictions are employing hazard mitigation policies and strategies, Table 5.12 presents a quick summary of the number of indicators included in each index, average inter-item correlations and alpha. On the whole, 12 of the 13 indices have alphas of .78 or higher; indeed 11 are .80 or greater. The only index that has a relatively low alpha is the federal incentive index, which incorporates only two measures associated with the National Flood Insurance Program and participation in the Community Rating System. While the relatively low alpha certainly leaves room for improvement, on the whole these finding suggest that these indices should provide consistent measurement of the extent to which jurisdictions are employing hazard mitigation strategies and policies.

Table 5.12 Summary of dependent variable indices

Hazard mitigation policy-strategy usage indices	Number of items	Inter-item correlation	Cronbach's Alpha
1. Land use and dev. regulations	7	0.33	.78
2. Shoreline regulations	5	0.58	.87
3. Natural resource protection	3	0.75	.90
4. Building standards	5	0.48	.82
5. Information dissemination	5	0.52	.84
6. Property acquisition programs	3	0.58	.80
7. Financial tools	3	0.65	.85
8. Local incentives	3	0.60	.82
9. Federal incentives	2	0.38	.55
10. Critical public-private facilities	3	0.71	.88
11. Public private initiatives	2	0.69	.82
12. Hiring professionals	3	0.59	.81
Hazard mitigation policy usage index	12	0.39	.88

5.2.2 Independent variables: capacity and commitment

Chapter II discussed the definition and elements of capacity and commitment. It also pointed out the problem in clarifying the relationship between these dimensions as a result of a strong correlation between capacity and commitment. Thus, the following section will provide more detail on key elements of capacity and commitment of local jurisdictions and how these elements are measured in this research.

5.2.2.1 Capacity

Considering the various dimensions of capacity mentioned in the literature review, seven variables were observed in corresponding to local jurisdiction capacities in adopting hazard mitigation policies and strategies. These include 1) the number of personnel, 2) budget allocation, 3) training, 4) support (individual(s)/group(s) within the jurisdiction), 5) stakeholders support for general planning, 6) financial sources, and 7) data sources. The number of indicators associated with these seven variables varies from one to ten.

5.2.2.1.1 Number of local jurisdictions' staff

Number of staff is a significant element of institutional capacity. The availability of human resources who work for hazard mitigation planning will influence the extent to which hazard mitigation policies and strategies are employed by local jurisdiction. Previous studies have found that increasing numbers of planning staff leads to higher plan quality as well as mitigation policies (Brody et al., 2010; Burby & May, 1998; Kang, 2009; Tang et al., 2009). Planning staff serve as internal consultants by providing skills needed by the planners (Kartez & Lindell, 1987; Lindell & Meier, 1994). They also handle administrative duties and direct planning implementation in the region (Schwab, 1998). Yet, not all cities or municipalities have a planning agency, so the availability of administrative staff including a mayor, city manager and staff, who are responsible for managing policies and regulations that can enhance hazard mitigation planning in the coastal areas are noteworthy. In other words, it is expected that the more personnel involved in the hazard mitigation planning, the more hazard land use and development regulations will be adopted. In this study, informants were asked to report the number of planners or administrative staff involved in hazard mitigation planning.

5.2.2.1.2 Staff training

Skilled and knowledgeable staff have been seen as one of the important indicators of capacity that affect the use of hazard mitigation policies and strategies. Alaerts et al., (1999) states that people' skills are the key issue in institutional capacity. Others suggest that local capacity includes the ability to facilitate staff improvement and allow them to take training to update their knowledge and skill (Brody et al., 2010; Grindle & Hilderbrand, 1995; Harvelt & Okun, 1991; Robins, 2008). Additionally, Berke & French (1994) suggest that technical skill is an important factor to prepare high quality plans.

As discussed in Chapter II, the abilities of trained staff in geographical information systems (GIS) are seen as major assets. GIS has been widely recognized as an ideal planning tool for analyzing coastal phenomena and it gives planners or other staff the ability to organize, store and analyze spatial information (Beatley, 2009; Schwab, 2010; Tang, 2009). FEMA uses GIS for Hazards US Multi-Hazard (HAZUS-MH) to estimate potential losses from hurricanes, windstorms, floods, and earthquakes (FEMA, 2011). This skill helps staff to understand the potential threat and the degree to which their jurisdiction needs policies and strategies for hazard mitigation. In addition to technical training, the ability of staff to attend training by FEMA is an indicator of local government capacity to improve the skills and technical expertise in implementing policies. FEMA provides many courses that allow participants to train in loss estimation and risk assessment, to use HAZUS results for mitigation and comprehensive planning (FEMA, 2011).

Furthermore, staff participation in training by professional association such as American Planning Association and National Emergency Management Association will also be significant elements in developing local capacity for coastal hazard mitigation. One study shows that a substantial amount damage from one disaster was triggered by the lack of properly qualified municipal staff to undertake design checks and to supervise building standards (Robins, 2004). Professional training provides local staff with the ability to determine best practices on planning and design for mitigation. However, some staff may have outdated training and may not attend the most recent versions. Therefore, the types and recency of training are significant elements of institutional capacity that influences the adoption of land use and development regulations. In this study, the indicators of training include FEMA training, technical training for computer programs, and training by professional associations. The informants were asked to rate the frequency with which any jurisdictional staff have been able to attend these types of training opportunities that addressed hazard mitigation issues within the past three years. Informants were provided with response categories ranging from *not at all (1); to very great extent (4)*. Table 5.13 shows inter-item correlations among the different types of training and the descriptive statistics.

Table 5.13 Inter-item correlations among training indicators

	Training	1	2	3	M	SD	Min	Max
1	FEMA training				2.97	.98	1	4
2	Technical training	.66*			2.21	.99	1	4
3	Training by professional association	.63*	.58*		2.47	1.05	1	4

Note: * $p \leq .05$ (2-tailed); $n = 124$

As can be seen in the table, all of these measures have moderate positive and statistically significant correlations. Because there are some variations among these correlations, the average intercorrelation can be increased by dropping one of these measures. However, the average inter-item correlation among these three measures remains moderately high .62, which yields an alpha of .83. Additionally, the table also displays the mean score of each type of training, which indicates that local staff received more training from FEMA than from professional associations and more training from the latter than in computer programs.

5.2.2.1.3 Budget allocation

Budget has been recognized as a crucial element for capacity. Beatley (2009) states that limited resources faced by coastal communities are often identified as a prime reason a particular action has not been taken. However, this does not mean that rich communities have adopted more land use and development regulations. The significant challenge is the ability of local jurisdiction to prioritize budgets for hazard mitigation and to ensure that policies are implemented. Assuming the budget is available and efficiently spent for planned activities, a larger budget will contribute to increased hazard mitigation policy implementation. In this research, the informants were asked to estimate the approximate annual budget in their jurisdictions devoted to hazard mitigation planning. The respond is an interval scale with 1) \$0–\$5,000; 2) \$5,001–\$10,000; 3) \$10,001–\$20,000; 4) \$20,001–\$50,000; 5) \$50,001–\$100,000, 6) \$100,001–\$300,000; and 7) \$300,001 or greater. The mean budget allocation is M= 2.56, and SD = 2.09, meaning that, on the average, local jurisdictions allocate between \$5,001 and \$20,000 annually for hazard mitigation planning.

5.2.2.1.4 Support within jurisdiction

The ability to perform hazard mitigation policy is influenced by support from individual(s) and group(s) within the jurisdiction. Alaerts at al. (1999) suggests that supports from individuals and groups are needed to help local governments achieve institution goals. Meanwhile, Beatley (2009) suggests that, in the system model of local politics, the relative power of individual and groups in the community is important in reaching community goals. He further suggests that coastal zone management decisions should involve all relevant parties such as land use planners and planning bodies, local elected officials, school and school districts, and business association/chambers of commerce (Beatley, 2009). In addition, Brody et al., (2010) state that leadership and networking with other individual and groups are key elements of capacity.

In this study, support within jurisdiction means any support from individual(s) as well as group(s) within the community. It includes support from elected officials, local jurisdiction’s staff, planning staff, emergency management staff/personnel, as well as support from business community, special districts and citizen in general. Informants were asked to indicate the general support for hazard mitigation planning from these sources using the response categories *poor (1), fair (2), good (3), very good (4), and excellent (5)*. Table 5.14 displays the inter-item correlations for these measures as well as the descriptive statistics.

Table 5.14 Inter-item correlations among supports within jurisdictions indicators

	Support	1	2	3	4	5	6	7	M	SD	Min	Max
1	Elected officials								3.54	1.09	1	5
2	Local jurisdiction's staff	.86*							3.46	1.14	1	5
3	Planning staff	.78*	.94*						3.56	1.14	1	5
4	EMC staff	.72*	.75*	.79*					3.79	1.05	1	5
5	Business community	.62*	.66*	.60*	.57*				2.92	1.17	1	5
6	Special districts	.66*	.68*	.66*	.59*	.81*			3.04	1.17	1	5
7	Citizen	.70*	.74*	.65*	.61*	.76*	.75*		2.94	1.10	1	5

Note: * $p \leq .05$ (2-tailed); $n = 124$

The intercorrelations among these items are all highly significant and quite strongly positive. The highest correlation (.94) is between planning staff and local jurisdiction staff, with the lowest correlation (.57) between the business community and emergency management staff. The average inter-item correlation among these measures is .71, yielding a high alpha of .94, which would not require dropping the business community. The average mean of general support for hazard mitigation planning is M = 3.32 and SD = .97, which may show that local jurisdiction has nearly received good supports from various individual and groups for hazard mitigation planning.

5.2.2.1.5 Stakeholder support for general planning

Not all Texas coastal jurisdictions have a stand-alone local hazard mitigation plan, so any support for general planning is useful for the hazard mitigation planning effort. As mentioned earlier, support from various groups is crucial for achieving institution goals, not only for addressing specific hazard mitigation policies and strategies but also land use and development planning in general. Therefore, support for general planning in this study means any support that may come from developers/realtors, property/land owners, hospital/medical industry, utilities (e.g., electric power, natural gas, and telecommunications), financial industry (e.g., insurance, banks, and mortgage companies), minority organizations, news media, neighborhood associations, environmental groups, and religious groups or faith-based organization. Informants were asked to characterize the support from those groups for general planning activities. Informants were provided with response categories g*roups (s) not present in jurisdiction (0), strongly opposed (1), opposed (2), neutral (3), supportive (4),* and *strongly supportive (5)*. Table 5.15 displays the correlations among these groups and table 5.16 presents the descriptive statistics.

Table 5.15 Inter-item correlation among support for general planning indicators

	Support general planning	1	2	3	4	5	6	7	8	9	10
1	Realtor/developer										
2	Property owner	.59*									
3	Hospital/medical	.52*	.39*								
4	Utilities	.44*	.41*	.47*							
5	Financial industry	.50*	.39*	.62*	.38*						
6	Minority organization	.50*	.32*	.65*	.32*	.67*					
7	News media	.38*	.33*	.57*	.39*	.63*	.61*				
8	Neighborhood association	.58*	.44*	.46*	.30*	.41*	.51*	.42*			
9	Environmental group	.33*	*.14*	.54*	.31*	.49*	.67*	.47*	.58*		
10	Religious group	.44*	.40*	.57*	.33*	.71*	.62*	.60*	.50*	.48*	

Note: * $p \leq .05$ (2-tailed); $n = 124$

While there is some variation in the strength of the correlations, these measures generally have moderate to strong positive correlations and all are statistically significant, except one correlation between environmental groups and property owners which has a low correlation value .14. The average intercorrelation for this set of measures is .47, yielding alpha .90. A case could be made for dropping property owner and environmental group measures, but the gains are limited and the inclusion of property owner and environmental group captures a range of variety groups within the community. Thus, it was decided to retain it in this set. Additionally, Table 5.16 shows that the environmental group provided the lowest level of support (*M* = 2.55) and the highest standard deviation (*SD* = 1.80). The overall mean score for support for general planning was mildly supportive (*M* = 3.20, *SD* = 1.01).

Table 5.16 Summary statistic support for general planning

Indicators	Mean	Std. Dev.	Min	Max
Developers/Realtors	3.35	1.24	0	5
Property/land owners	3.64	1.01	0	5
Hospital/medical industry	3.13	1.72	0	5
Utilities	3.77	1.15	0	5
Financial Industry	3.29	1.30	0	5
Minority Organization	2.73	1.58	0	5
News Media	3.28	1.37	0	5
Neighborhood Associations	3.02	1.54	0	5
Environmental Groups	2.55	1.80	0	5
Religious groups	3.21	1.35	0	5

N = 124

5.2.2.1.6 Financial resources

Adequate and secure financial resources are necessary for development and implementation (Chang & Desai, 2001; Toman & Bierbaum, 1996). Financial sources for hazard mitigation might not come exclusively from local government budgets. It can also come from federal or state government or from the private sector. Under FEMA mitigation programs, participating local governments have the opportunity to receive FEMA funds if they take certain pre-disaster mitigation actions. These include: 1) Section 406 Hazard Mitigation Grant Program fund, which is the largest source of federal funding for state and local mitigation activities (Schwab et al., 2007). 2) Small Business Administration Disaster Assistant Program funds, and 3) Pre-Disaster Mitigation Program funds that provides technical and financial assistance to state and local governments to assist in the implementation of pre-disaster hazard mitigation measures. This program is not dependent on disaster declaration (Schwab et al., 2007). In addition, local jurisdictions may also obtain state grants provided by the Texas General Land Office (TGLO) through program such as the Coastal Management Program (CMP), and the Beach Maintenance Reimbursement Fund (TGLO, 2011). Other funds can be acquired through Community Development Block Grants (CDBG) and other sources.

In this study, financial resources as indicator of capacity refers to the Section 406 Hazard Mitigation Grant Program (HMGP), Small Business Administration Disaster Assistant Program (SBA DAP), Pre-Disaster Mitigation Loan Program (PDM), Community Development Block Grants (CDBG), state funds such as Texas Coastal

Management Program Grants (TGLO), and local jurisdiction funds. Informants were asked to rate the degree to which their jurisdictions have used these different types of financial resources using the response categories ranging from *not at all (1)* to *very great extent (4)*. Table 5.17 presents the relationships among indicators in the financial measures and the descriptive statistics for each indicator.

The inter-item correlations among financial resources indicators are all positive and most are statistically significant. Two of the fifteen relationships are statistically nonsignificant, despite the fact that they have positive relationships.

Table 5.17 Inter-item correlations among financial source indicators

	Financial source	1	2	3	4	5	6	M	SD	Min	Max
1	CDBG							2.52	1.21	1	4
2	TGLO	.37*						1.58	0.97	1	4
3	Sec 406 HMGP	.23*	.52*					1.77	1.02	1	4
4	SBA/DAP	.29*	.49*	.50*				1.37	0.60	1	3
5	PDM	*.16*	.37*	.37*	.53*			1.19	0.47	1	3
6	Local jurisdiction fund	.25*	.34*	.49*	.31*	*0.13*		2.36	1.01	1	4

Note: * $p \leq .05$ (2-tailed); $n = 124$

These two are the .16 correlation between the Pre-Disaster Mitigation Loan Program (PDM) and Community Development Block Grants (CDBG) and the .13 correlation between local jurisdiction funds and PDM. The average inter-item correlation among these six measures is .36, yielding alpha .74. The weak correlations are probably due to the fact that local jurisdictions may not utilize PDM program. However, dropping the PDM item would not boost the average inter-item correlation and increase alpha. Therefore, in the interest of capturing a various range of financial sources within local jurisdiction, the PDM item will be retained. In addition, the above table displays the mean scores of each financial resource. Overall, the mean score for the financial resources used by local jurisdictions is 1.80 with SD = .60, which indicates that coastal communities use only a limited number of financial resources for hazard mitigation.

5.2.2.1.7 Data sources

Information or data availability is a key indicator of capacity. Earlier scholars suggest that technical resources and current information is essential for decision-making, planning and implementation of hazard mitigation (de Loë, Di Giantomasso, and Kreutzwiser, 2002; Tang, 2008). As data is dynamic, the ability to acquire and use the information is important in achieving goals (Alaerts et al., 1999). Risks area maps help jurisdictions to assess the probability of their community being affected by different hazards. In addition, US census data can be used to analyze people's vulnerability and economic data can be used to identify the risk of losses in business and economic activities when an event occurs. In this study, data sources include aerial photos, topographical maps, land use/parcel maps, risk area/hazard prone data, sensitive environmental area location maps, US Census data, population projections, economic data, HAZUS program/estimation, and the Coastal Planning Atlas. Informants were asked to rate the degree to which their jurisdictions have used each type of data source using four response categories ranging from *not at all (1)* to *very great extent (4)*. Table 5.18 shows that the relationships among the data source indicators and Table 5.19 displays descriptive statistics for the data sources items.

Table 5.18 Inter-item correlation among data source indicators

	Data source	1	2	3	4	5	6	7	8	9	10
1	Areal map										
2	Topographical map	.80*									
3	Land use map	.68*	.67*								
4	Risk area data	.53*	.59*	.67*							
5	Sensitive area	.56	.57*	.62*	.62*						
6	US census data	.51*	.43*	.54*	.44*	.56*					
7	Population projection	.44*	.38*	.52*	.46*	.63*	.63*				
8	Economic data	.36*	.32*	.49*	.44*	.46*	.57*	.72*			
9	HAZUZ program	.35*	.30*	.36*	.36*	.41*	.43*	.45*	.46*		
10	Coastal atlas	.37*	.31*	.37*	.22**	.46*	.35*	.50*	.43*	.64*	

Note: * $p \leq .05$ (2-tailed); $n = 124$

The table shows that there is some variation in the strength of the correlations, but these measures have moderate to strong positive correlations and all are statistically significant. The highest inter-item correlation is between topographical map and areal map (.80) and the lowest is between coastal atlas and risk area data (.22).

Table 5.19 Summary statistic data source index

Variable	Mean	Std. Dev.	Min	Max
Areal map	2.77	1.11	1	4
Topographical map	2.81	1.02	1	4
Land use map	2.79	1.01	1	4
Risk area data	2.88	1.05	1	4
Sensitive area	2.01	1.05	1	4
US census data	2.61	0.90	1	4
Population projection	2.08	0.88	1	4
Economic data	2.22	0.94	1	4
HAZUZ program	1.61	0.90	1	4
Coastal atlas	1.39	0.74	1	4

The weakest correlation here is probably due to the fact that not all local jurisdictions are aware of the Coastal Planning Atlas, a tool that developed by Texas A&M University to help local jurisdictions assess the potential impacts of future growth along the Texas coast. Overall, the average inter-item correlation among data sources is .49, which yields a high Cronbach's alpha of .91. Since dropping the Coastal Planning Atlas will not change the alpha, this item will be retained.

Interestingly, the descriptive statistics show that the mean score for the Coastal Planning Atlas is the lowest (1.39), while the overall mean score for data sources is moderate (M = 2.32, SD = .71). This overall result suggests that local jurisdiction moderately used various types of data sources.

5.2.2.1.8 A combined of capacity variable

When considering combining all the key elements of capacity that may influence the adoption of non-structural mitigation strategies, a number of factors need to be considered. First, similar to the dependent variables, there are variations in the number of elements of specific indicators, ranging from 1 to 10, across the seven indices of capacity. Simply combining the measures would weight indices with larger numbers of items. Second, the measurement of indicators is also varied. Therefore, a combined index was created by first standardizing each capacity index and then adding all seven to create the overall capacity index.

Table 5.20 displays the inter-item correlations among the seven capacity indices. It can be seen from the table that all correlations are positively and statistically significant except the relationship between support for general planning and annual budget that is positively correlated but not statistically significant (.07). The average intercorrelation among the seven indices is .38, yielding alpha .81. Deleting support for general planning form the overall composite does not change the alpha value. In addition, as discussed in the literature review that land use planning in general can be an effective for hazard mitigation. Therefore, stakeholder support for general planning will be retained as an element in the capacity variable.

Table 5.20 Correlation capacity indices (standardized)

	Capacity	1	2	3	4	5	6	7
1	Staff hazard mitigation							
2	Annual budget	.46*						
3	Training	.23**	.37*					
4	Support	.40*	.33*	.39*				
5	General planning support	.27*	*.07*	.27*	.43*			
6	Financial source	.24*	.39*	.49*	.34*	.30*		
7	Data source	.34*	.50*	.51*	.51*	.42*	.65*	

Note: * $p \leq .05$ (2-tailed); $n = 124$

In addition, as discussed in the literature review that land use planning in general can be an effective for hazard mitigation. Therefore, stakeholders support for general planning will be retained as a key element in capacity variable. Overall, these finding also suggest that the combined index will consistently capture the elements of capacity indicators which are key factors for local jurisdictions to adopt hazard mitigation policies and strategies.

Table 5.21 Summary of capacity indices

Capacity	Number of items	Inter-item correlation	Alpha (α)
1. Number of personnel	1		
2. Budget allocation	1		
3. Training	3	0.624	0.832
4. Support within jurisdiction	7	0.709	0.944
5. Stakeholders' support for general planning	10	0.474	0.899
6. Financial sources	6	0.356	0.737
7. Data sources	10	0.488	0.905
Capacity (all indicator combined)	7	0.377	0.809

Table 5.21 presents a summary of the number of indicators included in each index, the average inter-item correlation within that index, and the alpha for that index. Overall, five out of seven indices that have more than one item have alphas of .74 or higher; indeed four of them have alphas higher than .83. These findings suggest high levels of consistency for majority of indices.

5.2.2.2 Commitment

As mentioned earlier, capacity and commitment are intertwined. However, in this study, the dimensions of commitment for hazard mitigation will be differentiated from dimension of capacity. Based on the literature review, the indicators of commitment focused on 1) the willingness to work together or have a coordination with other neighboring jurisdictions; 2) the willingness to allocate staff time for hazard mitigation planning; 3) the willingness to involve with other department/agency (within jurisdiction); and 4) involve with state agency and lastly, 5) the willingness to have a formal agreement other institutions for hazard mitigation planning.

5.2.2.2.1 Coordination

The willingness of local jurisdictions to work together and coordinate with other neighboring jurisdictions is important as environmental hazards do not recognize political boundaries. Coordination is thus an active process by which administrative staff reduce losses from coastal hazards. In addition, pre-impact land use management activities such as restricting development along a river or shoreline often cannot be done by a single jurisdiction acting alone. Godschalk et al. suggest that local governments may choose to coordinate their mitigation strategy with adjacent jurisdictions or a group of jurisdictions within a larger region (1999). Therefore, working with other jurisdictions is a key indicator of commitment in employing hazard mitigation policy and strategies. If local jurisdictions are willing to collaborate with each other, more hazard mitigation policies and strategies are likely to be employed. In this research, informants were asked whether their jurisdictions worked with or coordinated with other jurisdictions on hazard mitigation planning (yes = 1, no = 0). Overall, the mean score is .81 indicating that most jurisdictions coordinate with other jurisdictions.

5.2.2.2.2 Time allocation

The number of staff in a city or county planning agency that are involved in mitigation planning is not enough to measure the commitment of local jurisdictions in reaching the goal of hazard mitigation because the staff may not work full time on this activity. In addition, mitigation planning activities may not only be carried out by the planning agency and city administrator, but also by individuals that are assigned in planning and land use management related activities. Therefore, it is important to measuring the number of full time equivalent (FTE) staff that are allocated to hazard mitigation planning and implementation. Early studies found that the amount of staff time influences the adoption and implementation of hazard mitigation strategies (Burby & May, 1998). Informants were asked to indicate the number of staff who were working in each of the categories 0-20%; 21-40%; 41-60%; 61-80%; and 81-100%. The number of people in each range was multiplied by the percentage of effort and the resulting products were summed to produce the FTE. The findings varied considerably across 124 local jurisdictions, with overall mean score (M = 1.94, SD = 3.14, Min = 0, and Max = 20.22). This is probably due to the fact that Texas coastal jurisdictions vary significantly in size.

5.2.2.2.3 Involvement with individual/department

Involvement with other agencies within the jurisdiction is important as hazard mitigation policy and strategies need supports from multiple agencies. As Alaerts et al. (1999) mentioned, the support of other individuals, groups, and organizations/ institutions will help local jurisdiction to achieve their hazard mitigation goals. Many tools and strategies cannot be done by only one department or by the city manager or mayor. Assuming local jurisdictions are willing to involve other individuals and departments within their jurisdiction, there will likely more extensive use of hazard mitigation policies and strategies in Texas coastal communities.

To measure involvement, informants were asked to what extent individuals or departments such as elected officials, city manager, public works/engineering, planning/community development, economic development, building department, emergency management, environmental services, city/county attorney's office, county judge, housing department/authority, flood administrator, and parks/recreational department have been involved in hazard mitigation planning. They were provided with response categories from *group(s) not present in jurisdiction (0); Not at all (1); a small extent (2); to some extent (3);* and *to very great extent (4)*. Table 5.22 displays the correlations among these groups and Table 5.23 presents the descriptive statistics of the index.

Table 5.22 shows that the vast majority (73 of 78) of inter-item correlations for the willingness to work or the involvement of individual(s) and group(s) within jurisdictions are positively correlated and statistically significant. The strongest correlation (.74) is between economic development and planning department. There are five inter-item correlations that are positively correlated but not statistically significant. These are associated with county judge and the floodplain administrator. Specifically the county judge is not significantly correlated with city manager and building manager. Similarly the floodplain administrator is not significantly correlated with elected official, housing department and the parks and recreation department. The remaining 73 correlations reflect an expected overall positive association among these indicators. The average intercorrelation among these 13 indicators is .41, yielding a strong alpha of .88.

Table 5.22 Inter-item correlation within jurisdiction individual/department involvement indicators

	Involvement	1	2	3	4	5	6	7	8	9	10	11	12	13
1	Elected official													
2	City manager	.26*												
3	Public work	.43*	.57*											
4	Planning dept.	.41*	.54*	.66*										
5	Economic dev.	.40*	.45*	.49*	.74*									
6	Building dept.	.34*	.62*	.64*	.63*	.52*								
7	Emergency management	.48*	.32*	.52*	.44*	.41*	.45*							
8	Environmental services	.36*	.23*	.30*	.41*	.51*	.21*	.20						
9	City/county attorney's	.52	.29*	.47*	.48*	.58*	.44*	.46*	.40*					
10	County judge	.45*	*.13*	.22*	.29*	.35*	*.17*	.35*	.39*	.43*				
11	Housing dept.	.25*	.39*	.33*	.44*	.57*	.34*	*.17*	.43*	.43*	.36*			
12	Flood administrator	.37*	*.14*	.28*	.45*	.33*	.41*	.39*	.09	.40*	.27*	*.20*	1	
13	Park/rec. dept	.34*	.47*	.62*	.60*	.62*	.51*	.31*	.49*	.65*	.34*	.54*	*.18*	

Note: * $p \leq .05$ (2-tailed); $n = 124$

Table 5.23 displays the mean scores for the individual indicators. Overall, the average of individual(s) and department involvement within local jurisdictions is 2.35 with SD = .86, which may indicates there is a moderate degree of engagement within jurisdictions to carry out hazard mitigation policies and strategies.

Table 5.23 Summary statistic individual/department involvement

Variable	Mean	Std. Dev.	Min	Max
Elected official	2.98	1.00	0	4
City manager	2.69	1.47	0	4
Public work	2.94	1.31	0	4
Planning dept.	2.31	1.44	0	4
Economic dev.	2.00	1.32	0	4
Building dept.	2.70	1.40	0	4
Emergency management	3.16	1.32	0	4
Environmental services	1.60	1.40	0	4
City/county attorney's	2.21	1.26	0	4
County judge	2.34	1.53	0	4
Housing dept.	1.39	1.27	0	4
Flood administrator	2.93	1.38	0	4
Park/rec. dept	1.99	1.30	0	4

5.2.2.2.4 Involvement with state level agency

Involvement with higher level agencies is crucial not only for coordination, but also because regional and state agencies may also provide resources for hazard mitigation at the local level. Informants were asked to what extent individuals or departments within their jurisdictions were involved with regional and state agencies for hazard mitigation planning: Texas Department of Housing and Community Affairs (TDHCA), Texas Commission on Environmental Quality (TCEQ), Texas Department of Transportation (TxDOT), Texas Water Development Board (TWDB), Texas State Soil and Water Conservation Board (TSSWCB), Texas Parks and Wildlife Department (TPWD), Texas General Land Office (GLO), Texas Division of Emergency Management (TDEM), Texas Department of Rural Affairs (TDRA), and Regional Council of Government (COG). Response categories ranged from *not at all (1)* to *very great extent (4)*. Table 5.24 shows the inter-item correlations and Table 5.25 displays the summary statistics for these measures.

All of these measures have moderately positive, statistically significant correlations. The highest correlation (.80) is between Texas Water Development Board (TWDB) and Texas Commission on Environmental Quality (TCEQ) and the lowest is between Texas Division of Emergency Management (TDEM) and Texas Department of Housing and Community Affairs (TDHCA) (.35). The average intercorrelation among these ten measures is .54, which yields the highest overall alpha among the commitment indices of .92.

Table 5.24 Inter-item correlations among state agency involvement indicators

State involvement		1	2	3	4	5	6	7	8	9	10
1	TDHCA										
2	TCEQ	.58*									
3	TXDOT	.52*	.71*								
4	TWDB	.62*	.80*	.64*							
5	TSSWCB	.58*	.57*	.70*	.64*						
6	TPWD	.53*	.54*	.70*	.59*	.80*					
7	TGLO	.45*	.49*	.47*	.50*	.52*	.64*				
8	TDEM	.35*	.41*	.44*	.47*	.38*	.43*	.52*			
9	TDRA	.62*	.59*	.46*	.58*	.45*	.51*	.50*	.45*		
10	COG	.47*	.54*	.45*	.55*	.44*	.40*	.41*	.45*	.60*	1

Note: * $p \leq .05$ (2-tailed); $n = 124$

Table 5.25 shows the average involvement scores varied across the state agencies, with the highest involvement being with the regional Council of Governments (2.58) and the lowest involvement being with the Texas State Soil and Water Conservation Board (1.67). The overall mean score is 2.10, indicating that local jurisdiction moderately engage with the state agencies in Texas.

Table 5.25 Summary statistic involvement with state level agency

Variable	Mean	Std. Dev.	Min	Max
TDHCA	1.839	0.91	1	4
TCEQ	2.282	1.00	1	4
TXDOT	2.218	1.00	1	4
TWDB	2.113	1.00	1	4
TSSWCB	1.669	0.88	1	4
TPWD	1.734	0.94	1	4
TGLO	1.839	0.97	1	4
TDEM	2.718	1.08	1	4
TDRA	2.097	1.04	1	4
COG	2.581	1.13	1	4

5.2.2.2.5 Formal agreements

Other key element of commitment is agreement with groups or stakeholders within a community (Beatley, 2009; Grindle & Hilderbrand, 1995; Robins, 2008). This willingness to collaborate can be made manifest and potentially effective if formalized by a memoranda of understanding or agreement regarding each party's role in hazard mitigation planning. Formal agreements can be crucial and reflect a pronounced degree to which the coastal community procured commitment for *coordinated action* related to hazard mitigation policies and strategies. It is expected that communities with formal agreements will be more likely to adopt non-structural hazard mitigation policies and strategies.

As described in the literature review, there are many players in each local jurisdiction. In this study, local planning informants were asked whether they have formal memoranda of understanding/agreement for hazard mitigation planning with schools, utilities, health services providers, professional associations such as an engineer association, non-profit organizations (NPOs), faith-based organizations (FBOs), financial institutions such as bank and credit institution, and hospitality facilities such as hotels and motels. Informants were asked to state if they did (1) or did not (0) have a formal agreement with each type of organization. Table 5.26 displays the inter-tem correlation among these eight groups, while Table 5.27 presents the summary statistics for these indicators.

Table 5.26 Inter-item correlations among formal agreement indicators

	Agreement	1	2	3	4	5	6	7	8
1	Schools								
2	Utilities	.65*							
3	Health services	.57*	.50*						
4	Professional association	.41*	.29*	.35*					
5	Non-profit organization	.56*	.44*	.48*	.35*				
6	Faith-based organization	.42*	.50*	.41*	.35*	.57*			
7	Financial Institution	.38*	.30*	.32*	.44*	.28*	.38*		
8	Hospitality industry	.58*	.51*	.76*	.41*	.56*	.50*	.42*	

Note: * = $p \leq .05$ (2-tailed); $n = 124$

It can be seen in the table that the correlations among the measures associated with formal agreements are all positive and statistically significant, although there are some variations among the correlations. The highest correlation is between hospitality industry and health services (.76) and the lowest is between financial institutions and NPOs (.28). The average inter-correlation among these eight measures is .45, which yields a high alpha of .87. Dropping the correlation of financial institutions with NPOs does not affect the average correlation and increase alpha. Therefore, although this is a weak correlation, using the entire list captures a broader range of groups with which local jurisdictions are willing to have formal agreements.

Meanwhile, Table 5.27 displays the mean number of jurisdictions having formal agreements with each of the eight different types of groups. The overall mean score .45 indicates that local jurisdictions in Texas coastal areas are quite willing to establish formal agreements with various groups in their communities.

Table 5.27 Summary statistics agreement index

Variable	Mean	Std. Dev.	Min	Max
Schools	0.56	0.50	0	1
Utilities	0.60	0.49	0	1
Health services	0.45	0.50	0	1
Professional association	0.31	0.46	0	1
Non-profit organization	0.56	0.50	0	1
Faith-based organization	0.40	0.49	0	1
Financial Institution	0.24	0.43	0	1
Hospitality industry	0.46	0.50	0	1

5.2.2.2.6 A combined of commitment variable

As was the case with capacity, a number of factors need to be considered when considering combining all of the elements of commitment that can influence the adoption and implementation of non-structural hazard mitigation strategies. First, there are variations in the number of elements of specific indicators, ranging from one to 13, across the five indices of commitment. Simply adding the measures would, in effect, more heavily weight scales with more items. Second, the measurement of indicators is also varied. Therefore, the overall commitment index was created by first standardizing each of the five commitment indices and then averaging the five standardized sub-indices. Table 5.28 presents a summary of the number of indicators included in each index, the average inter-item correlation, and the resulting alpha. Overall, the three indices that have more than one item have alpha higher than .87. These findings suggest high levels of internal consistency reliability for these indices.

Table 5.28 Summary statistics of commitment indices

Commitment	**Number of items**	**Average inter-item correlation**	**Alpha (α)**
Coordination with other jurisdictions	1		
Time allocation	1		
Dept/agency involvement	13	0.405	0.875
State agency involvement	10	0.535	0.918
Agreements with other institutions	8	0.453	0.871
Commitment (all indices are standardized and combined)	5	0.352	0.731

Table 5.29 Correlations among commitment indices

	Commitment	1	2	3	4	5
1	Coordination with other jurisdiction					
2	Individual (s)/agency involvement	.36*				
3	State involvement	.29*	.43*			
4	Time allocated/FTE	.23*	.26*	.25*		
5	Formal agreement	.37*	.54*	.43*	.36*	

Note: * $p \leq .05$ (2-tailed); $n = 124$

Table 5.29 displays the inter-item correlations among all commitment indices. It can be seen from the table that all five are positively correlated and statistically significant. The strongest correlation (.54) is between formal agreements and individual/agency involvement and the rest of the correlations are below .5, suggesting moderately positive relationship. The overall average inter-correlation among the five indices is .35, yielding an alpha of .73. This result suggests that, while there is some room for improvement, the combined index of commitment will reliably measure local jurisdictions' commitment to adopting and implementing hazard mitigation policies and strategies.

5.2.2.3 Control variables

There are some additional factors influencing local capacity and commitment to adopting hazard mitigation policies and strategies that are included in this analysis. As discussed in the literature review, the first factors that are identified as key variables are jurisdiction type and the location of a jurisdiction within the CZM area. In general it is expected that coastal municipalities will employ more hazard mitigation policies and strategies than coastal counties because home rule provides municipalities with the power to enact a greater variety of these ordinances, particularly those related to building codes and many land-use policies. However, in Chapter IV, the results indicate that there are only statistically significant differences between cities and counties in employing building standards, development regulations, information dissemination and public-private initiatives. While counties more extensively employ the latter two programs, cities are more likely to employ the former two. These findings suggest that the type of jurisdiction and its powers, structures, and functions do influence the types of hazard mitigation policies and strategies practices at the local level. In this study, jurisdiction type was coded as a dummy variable (municipality = 1 and county = 0).

In addition, jurisdictions in CZM areas have the opportunity to access resources from the state through the Texas Coastal Zone Management Program, which provides support for regulatory and non-regulatory land use planning in these areas. Therefore, coastal communities located in the CMZ are expected to adopt and more extensively employ land use and development regulations that can enhance hazard mitigation. Similar to jurisdiction type, a dummy coded identity variable where jurisdictions located within the CZM area are coded as 1 and those outside the CZM area are coded as 0.

Second, hazard experience and hazard exposure have been identified as significant variables that might promote land use and development regulations for coastal hazard mitigation. In this study, hazard experience was measured by the extensiveness of damage that a local jurisdiction experienced from any type of coastal hazards in the past 10 years. Local informants were asked to report damage as resulting from floods, coastal storms (including hurricanes), tornadoes, hail, excessive heat, droughts, wildfires, thunderstorms, coastal erosion, technological hazards, subsidence and sea-level rise. Informants were provided with response categories ranging from *never (1) to major (4)*. Table 5.30 displays the inter-item correlations among these 12 types of coastal hazards.

Table 5.30 Inter-item correlations among hazard experience indicators

		1	2	3	4	5	6	7	8	9	10	11	12
1	Flood												
2	Coastal storms	0.50*											
3	Tornados	0.44*	0.26*										
4	Hail	0.38*	0.18*	0.45*									
5	Excessive heat	0.33*	0.01	0.22	0.46*								
6	Drought	0.17	-0.05	0.24*	0.43*	0.74*							
7	Wildfires	0.17	-0.01	0.26*	0.25*	0.44*	0.51*						
8	Thunderstorms	0.37*	0.19*	0.37*	0.56*	0.54*	0.43*	0.22*					
9	Coastal erosion	0.22*	0.29*	0.00	-0.07	-0.01	-0.06	-0.01	-0.01				
10	Tech hazard	0.36*	0.29*	0.26*	0.28*	0.27*	0.15	0.24*	0.32*	0.22*			
11	Subsidence	0.17	0.20*	0.05	0.06	-0.03	-0.12	-0.16	0.09	0.29*	0.32*		
12	Sea-level rise	0.29*	0.27*	0.18*	0.13	0.14	-0.01	0.02	0.21*	0.60*	0.39*	0.40*	

Note: * $p \leq .05$ (2-tailed); $n = 124$

The table shows that the correlations vary substantially in their magnitude. Of the 66 correlations, 42 are positive and statistically significant. The strongest correlation (.74) is between drought and excessive heat, which have an obvious logical relationship. It can also be seen that there are some negative correlations among some measures. The non-significant correlations are associated with coastal erosion, drought, wildfire and excessive heat.

While a few correlations have negative signs as in the case of coastal erosion and drought, wildfires and excessive heat, these are non-significantly different from zero. Similarly, coastal storms are not significantly correlated with drought and wildfires. The average correlation among these 12 items is .23, which yields an alpha of .77. There is no significant increase of alpha if coastal erosion or other measures with low correlations are dropped. Moreover, the inclusion of coastal erosion, particularly, is important in assessing damage in coastal areas. Therefore, all 12 measures have been retained to capture overall levels of hazard experience for local jurisdictions.

Similar to hazard experience, the literature also suggests that areas with higher hazard exposure should be more likely to adopt and utilize hazard mitigation strategies and policies. For the purposes of this research exposure in terms of the 100-year floodplains and storm surge areas are considered as factors potentially influencing community adoption of strategies to reduce impacts of coastal hazards. The 100-year floodplain refers to an area that has a one percent chance of flooding in a given year. The higher the percentage of inland floodplains in coastal communities, the greater their risk of casualties and property loss. Thus, local jurisdictions with larger areas in floodplains are expected to adopt more hazard mitigation policies and strategies. In this study, the percentage area in the 100-year floodplain for inland flooding was obtained from GIS data in the Texas Coastal Atlas at http://coastalatlas.tamug.edu/. The area in each local jurisdiction's inland floodplain was divided by the jurisdiction's total area to produce the percentage of inland flood risk area.

In addition to floodplain, this study also used areas expected to experience storm surge inundation as a control variable. Storm surge is caused by high wind that raises the water level higher than the ordinary tide level. As was the case with inland flooding, the higher the percentage of coastal (storm surge) floodplains in coastal communities, the greater their risk of casualties and property loss. Thus, communities that have larger areas exposed to storm surge are also expected to adopt more hazard mitigation policies and strategies. Similar to floodplain area, the percentage of storm surge area was calculated using the GIS data from the Texas Coastal Atlas. The area in each local jurisdiction's surge risk areas 1 through 5 was calculated and divided by the jurisdiction's total area to produce the percentage of storm surge risk area.

The last factors that may influence local jurisdiction capacity and commitment in adopting land use and development regulations are total population and population change. It is expected that coastal communities with large populations will have the capacity and commitment to adopt more land use and development regulations. In addition, a rapidly growing population is expected to also affect the adoption of land use and development regulations that can enhance hazard mitigation. *Population* is measured by the number of people in a jurisdiction. Since cities are located within counties, the population of a county was measured by the number of people in unincorporated areas. This was computed by subtracting the number of people in sampled municipalities of a county from the total number of people in that county. *Population change* was calculated by subtracting a jurisdiction's population in 2000 from its population in 2009 and then dividing by the 2000 population base.

5.2.2.4 Summary

Before discussing the hypotheses, it is important to summarize this chapter's discussion of the conceptual framework and measurement procedures. First, the dependent variables of this research consists of 12 different indices reflecting the different types of hazard mitigation policies and strategies and a single combined index. Each index reflects the extent to which each type or over all these policies have been adopted and utilized. Second, the primary independent variables are capacity and commitment. Capacity was measured by the number of personnel, budget allocation, training, support from individual(s)/group(s) within jurisdiction, stakeholders' support for general planning, financial sources, and data sources. Commitment was measured by coordination with other jurisdictions, time allocation, formal agreements, involvement with other departments/agencies (within the jurisdiction), and involvement with state agencies. Third, control factors were measured consisting of jurisdiction type and location, hazard experience, hazard exposure, population size, and population change. Table 5.31 provides summary statistics for all variables that will be analyzed further in Chapter VI.

Table 5.31 Summary statistics of the dependent variable and independent variables

Variable	**Mean**	**SD**	**Min**	**Max**
Development regulations	1.326	0.726	0	3
Shoreline regulations	0.587	0.827	0	3
Natural resource protection	0.817	1.024	0	3
Building standards	1.719	0.906	0	3
Information dissemination	0.835	0.751	0	3
Local incentives	0.156	0.415	0	2
Federal incentives	2.016	0.943	0	3
Financial tools	0.153	0.476	0	3
Property acquisition programs	0.376	0.663	0	3
Critical public-private facilities	0.737	0.888	0	3
Public private initiatives	0.319	0.673	0	3
Hiring professionals	0.852	0.910	0	3
Composite haz-mitigation index	0.825	0.505	0	2.343
Capacity	0.000	0.683	-1.500	1.916
Commitment	0.000	0.694	-1.496	1.987
Municipality	0.790	0.409	0	1
CZM	0.435	0.498	0	1
Hazard experience	2.122	0.453	1.083	3.417
Floodplain area	22.429	25.418	0	100
Surge risk area	30.278	40.158	0	100
Population	77,779	417,589	40	4,070,989
Population change	10.385	25.077	-11.89	172.67

N = 124

5.3 Hypotheses

The central hypothesis of this study is that local jurisdictions with higher levels of capacity and commitment are predicted to adopt and utilize hazard mitigation policies and strategies at higher levels. Thus, there are two primary hypotheses that will be tested:

H_1: Coastal jurisdictions with greater capacity will have greater adoption/utilization levels of hazard mitigation policies and strategies.

H_2: Coastal jurisdictions with greater commitment will have greater adoption/utilization levels of hazard mitigation policies and strategies.

In addition, when considering the additional control variables the following six secondary hypotheses reflect general expectations:

H_3: Municipalities will have higher adoption/utilization levels than counties.

H_4: Local jurisdictions located in CMZ area will have higher adoption/utilization levels than communities outside the CMZ.

H_5: Local jurisdictions with a higher percentage of their area in floodplain will have higher adoption/utilization levels.

H_6: Local jurisdictions with a higher percentage of their area in storm surge zones will have higher adoption/utilization levels.

H_7: Local jurisdictions with larger populations will have higher adoption/utilization levels.

H_8: Local jurisdictions with greater percentage change in population will have higher adoption/utilization levels.

CHAPTER VI

FACTORS INFLUENCING THE EXTENT TO WHICH HAZARD MITIGATION POLICIES AND STRATEGIES ARE EMPLOYED

This chapter examines the extent to which capacity and commitment influence the extent to which Texas coastal jurisdictions adopt and implement land use and development regulations that are important for hazard mitigation. In addition, other factors such as jurisdiction type and location, hazard experience and exposure, as well as population characteristics are expected to affect local jurisdictions' adoption of land use and development regulations.

The chapter will begin with a correlational analysis among dependent, independent, and control variables followed by a regression analysis to test the hypotheses. Correlation analysis is undertaken to assess the overall relationship patterns as expected by the theoretical framework outlined in Chapter III as well as to see if the overall relationship patterns among the independent variables are consistent with the general theoretical relationships (Babbie, 2005; Carmines and Zeller, 1979). This will also alert us to potential issues among the independent variables. The regression analysis is conducted to examine the influences of the independent variables on the dependent variables. In this study, the 12 indices of dependent variables (development regulations, shoreline regulations, natural resource protection, building standards, information dissemination, local and federal incentives, financial tools, property acquisition, critical facilities, public-private initiatives, and hiring professionals for mitigation) and the combined hazard mitigation policy index will be separately regressed against capacity, commitment, and control variables.

6.1 Correlations of dependent, independent, and control variables

A Pearson's product-moment correlation analysis was used to examine the relationships among the independent and dependent variables. Table 6.1 presents correlations among the variables. The upper left triangle, which is shaded gray, presents the intercorrelations among the 13 dependent variables; the lower right triangle, which is shaded green, presents the intercorrelations among the independent variables; and the rectangular matrix, formed by rows 14-22 and columns 1-13 (shaded blue), presents the correlations between the 13 dependent variables and the 9 independent variables.

While the intercorrelations among the 12 individual policy indices have already been examined in the previous chapter, row 13 displays their correlations with the composite hazard mitigation policy index. Not surprisingly all these correlations are positive, quite strong, and most are statistically significant. The lowest correlation is between the composite and the federal incentive policy index at .49. This federal incentive measure also has the lowest correlations among other dependent variables; indeed two (see row 7) are not statistically significant. On the whole, however, the overwhelming pattern is, as might be expected, one of positive correlations among these indices.

Table 6.1 A complete correlation matrix between 12 indices of dependent, combined dependent, independent, and control variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1																						
2	.32**																					
3	.47**	.64**																				
4	.53**	.30**	.37**																			
5	.34**	.35**	.42**	.32**																		
6	.49**	.42**	.40**	.29**	.40**																	
7	.27**	.13	.22*	.26**	.46**	.14																
8	.39**	.42**	.34**	.16	.39**	.68**	.18*															
9	.42**	.40**	.37**	.27**	.52**	.62**	.29**	.70**														
10	.52**	.29**	.36**	.40**	.57**	.46**	.23*	.49**	.55**													
11	.29**	.33**	.26**	.13	.60**	.42**	.27**	.57**	.67**	.47**												
12	.43**	.38**	.54**	.46**	.46**	.36**	.21*	.31**	.42**	.42**	.29**											
13	.69**	.63**	.71**	.60**	.73**	.66**	.49**	.64**	.74**	.72**	.63**	.69**										
14	.36**	.28**	.34**	.40*	.56**	.34**	.48*	.22*	.48**	.36**	.41**	.38**	.59**									
15	.48**	.20**	.34**	.36*	.61**	.43**	.39*	.36*	.48*	.52**	.41**	.41**	.62**	.73**								
16	.20*	.22**	.27**	.18*	.48**	.19*	.34**	.27**	.31*	.29**	.38**	.28**	.43**	.47**	.35**							
17	.01	.14	.11	.01	.16	.14	.14	.06	.18*	.07	.13	.02	.14	.22*	.15	.07						
18	.22*	-.03	-.01	.10	-.12	.01	-.03	-.06	-.06	.17	-.10	.13	.04	-.01	-.04	.03	.11					
19	.17	.01	-.07	.35**	-.26*	.00	-.13	.06	-.07	.12	-.17	.05	.01	-.29**	-.16	-.23**	-.17	.08				
20	.04	.37**	.25**	.31**	.21*	.17	.17	.12	.12	-.00	.17	.11	.26**	.29**	.11	.25**	.15	-.22*	.01			
21	.14	.43**	.34**	.44*	.28**	.15	.21*	.06	.13	.03	.04	.39**	.36**	.19*	.11	.16	-.01	-.01	.04	.39**		
22	-.00	.21*	.11	.34**	.13	-.01	.08	.05	-.01	-.04	.07	.07	.14	.21*	.07	.17	-.08	-.20*	.11	.74**	.31**	1

Note: * p<.05 level; ** p <.01 level (2-tailed)

(1) Development regulations; (2) Shoreline regulations; (3) Natural resource protection; (4) Building standards; (5) Information dissemination; (6) Local incentives; (7) Federal incentives; (8) Financial tools; (9) Property acquisition programs; (10) Critical facilities; (11) Initiatives; (12) Hiring professionals; (13) HMP adoption; (14) Capacity; (15) Commitment; (16) Hazard experience/exposure; (17) Population 2009; (18) Population change (2000-2009); (19) Municipality; (20) Inside Coastal Management Zone (CMZ) ; (21) Floodplain area; (22) Storm surge zone area

Row 14 displays the correlations between the capacity index and all dependent variables. Capacity is positively and significantly correlated with all 13 dependent variables. The strongest correlation (.59) is between capacity and the composite hazard mitigation policy index, while the weakest (.22) is between capacity and the financial tools index. On the whole, these results are quite consistent with the expectation that the greater a jurisdiction's capacity the more extensively they have actually adopted and implemented hazard mitigation policies.

The relationships between the commitment index and the dependent variables are quite consistent with the pattern seen for capacity. Commitment is positively and significantly correlated with all of the policy indices and the composite index. Moreover, as with capacity, the strongest correlation is with the composite index. These significant positive correlations clearly indicate that the greater the commitment of coastal communities, the more likely they were to employ each type of land use and development regulation. It is also interesting to note that, in comparison to capacity, commitment correlations are higher for 9 of these 14 correlations, suggesting that commitment might well be a slightly stronger factor than capacity.

The correlations between the control variables and the dependent variables are can be found in rows 16-22, beginning with hazard experience. A local jurisdiction's experiences with coastal hazards has a solid relationship with how extensively they have employed hazard mitigation policies across the board. All relationships are positively correlated and statistically significant. The strongest correlations are between experience and hazard information communication and education programs and the composite hazard mitigation policy index. These findings clearly suggest that coastal community hazard experienced during the last decade is positively associated with the extent to which hazard mitigation policies and regulations are employed.

The control measures have somewhat less consistent relationships with the dependent variables but, nevertheless, there are consistently significant relationships of a variety (seven each) of hazard policy indices with the measures of location in the CMZ (row 20) and floodplain hazard exposure (row 21). These correlations suggest that CMZ jurisdictions are making more extensive use of shoreline regulations (.37), natural resource protection (.25), building standards (.31), hazard information/education programs (.21), and the composite hazard mitigation index (.26). The correlations in row 21, show that a jurisdiction's floodplain exposure is positively correlated with more extensive usage of shoreline regulations (.43), natural resource protection (.34), building standards (.43), hazard information dissemination and education programs (.28), federal incentives (.21), hiring professionals (.39) and the composite hazard mitigation policy index (.36). Interestingly, surge zone hazard exposure has only one statistically significant and positive correlation. Jurisdictions with higher percentages of their areas in surge zones make more extensive use of building standards (.34).

The relationships of the municipality indicator variable with hazard mitigation programs are consistent with the findings discussed in Chapter IV that tested for mean usage difference between municipalities and counties. The municipality variable (see row 19) is positively associated with extensive use of building codes/standards (.35) and negatively correlated with hazard information/education programs (-.26). These findings again indicate that, while municipalities make more extensive use of building codes, counties make more extensive use of hazard education programs. The final two control measures are population (row 17) and population change (row 18). Contrary to expectations, none of relationships of population and population change with the mitigation program indices are significant.

There are a number of interesting correlations among the independent variables themselves. Not surprisingly there is a strong correlation between capacity and commitment of .73 as well as between CMZ and the percentage of a jurisdiction's area in surge zones (.74). These high correlations have the potential of presenting multicollinearity problems for the regression analysis. However, assessments of tolerance and variance inflation factors suggest that these are not problematic.[5] It is interesting to note that communities that are high in both capacity and commitment have also had relatively high levels of hazard experience. Capacity also is positively associated with CMZ and percent of a community's area in both flood and surge zones; nevertheless, the same cannot be said for commitment because there are no significant correlations between commitment and these measures. Perhaps the most unexpected findings are the significant negative correlations of the municipality indicator with capacity and hazard experience. It may well be that counties, given their larger landmass, simply had greater opportunity to have experienced higher levels of damage

[5] All the variables have variance inflation factors less than 3, which is considered tolerable and the average VIF is 1.84. More importantly, all have tolerances of .35 or greater, suggesting that they all have sufficient independent variances remaining.

than cities. Furthermore, municipalities in this sample have a substantial range in size and complexity, but they have fewer resources on average than counties.

The correlation analysis suggests that the key variables of capacity and commitment generally have positive effects on the extent to which jurisdictions adopt and implement hazard mitigation policies. However, many of the control variable also exhibited significant relationships with the policy indices and also with capacity and commitment and, equally important, these were strongly correlated with each other. Hence, regression models must be used to better isolate the unique effects of capacity and commitment on the extent to which jurisdictions are employing hazard mitigation policy, after controlling for other independent variables.

6.2 Factors influencing the extent to which hazard mitigation policies and strategies are employed

A series of 13 ordinary least square (OLS) regression models were used to estimate the effects of capacity, commitment, and control variables. The first twelve models examined the impact of capacity, commitment, and control variables on the 12 separate hazard mitigation policy indices of dependent variables with an addition model employing the composite hazard mitigation policy index. The OLS models were performed by fitting the following model to each of the dependent variables,

$$DV = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \varepsilon$$

where the DV is one of the 12 policy indices: (1) development regulations index; (2) shoreline regulations index; (3) natural resource protection index; (4) building standards index; (5) information dissemination index; (6) local incentives index; (7) federal incentives index; (8) financial tools index; (9) property acquisition index; (10) critical public and private facilities index; (11) public-private initiatives index; (12) hiring professionals index, or (13) the combined hazard mitigation policies index (HMP). The independent variables are: X_1= Capacity index, X_2 = Commitment index, X_3 = Municipality, X_4 = Location in CMZ, X_5 = Hazard experience index, X_6 = Flood plain area, X_7 = Storm surge area, X_8 = Population, and X_9 = Population change. The coefficients β_1, through β_9 are partial regression coefficients that represent the unique effects of the specific independent variables on the dependent variable controlling for other independent variables. For instance, β_1 represents the effect the capacity variable has on a particular hazard mitigation adoption, after controlling for the effects of other independent variables in the model.

The OLS regression modeling results for the 12 hazard mitigation policy areas are summarized in Tables 6.2 and 6.3. These tables present the unstandardized coefficients (*b*), standardized coefficients (β), and R^2. While *F*-statistics are not presented, their significance is indicated on the R^2 statistics. The results for *t*-tests of the coefficients are indicated on each coefficient. Since there is a clear theoretical expectation that the key independent variables should have positive effects on the extent to which hazard mitigation policies are utilized, one tail results are presented. However, two tailed results are presented for the control variables because there are not strong hypotheses about the direction of the relationships with the dependent variables.

Examination of the models in both tables clearly indicates that all models are statistically significant. Indeed, the R^2 values for these models are quite respectable, ranging from a low of 19.7% for the model predicting the use of financial tools, consisting of special taxes and impact fees—the least favorite of the hazard mitigation policy packages, to a high of 52.8% for the model predicting the use of building standards—one of the more popular hazard mitigation policy packages for Texas coastal communities. Interestingly, capacity or commitment (or both) are significant in 11 of 12 models, the exception being the model predicting shoreline regulations. There is considerable variation among the other models in terms of which additional control variables are significant. The following sections will address the specific findings by addressing the results for each independent variable in turn.

6.2.1 Community capacity

The findings in Table 6.2 suggest that capacity has a statistically significant and positive effect in three out of the 12 models predicting the extensiveness to which specific sets of hazard mitigation policies and strategies are being employed. More specifically the findings indicate that jurisdictional capacity has a positive effect on the extent to which building standards, federal incentives, and property acquisitions policies and strategies are being employed.

These results further suggest that, in each of these models, capacity has one of the most, if not the most important relative effects among the independent variables, as assessed by the standardized coefficients.

Table 6.2 OLS regressions between 12 indices of dependent, independent and control variables (Part 1)

Dependent		(1) Development regulation	(2) Shoreline regulation	(3) Natural resource protection	(4) Building standards	(5) Information dissemination	(6) Local incentives
Capacity	b	0.09	0.14	0.09	0.42**	0.06	0.01
	ß	0.08	0.12	0.06	0.32**	0.06	0.02
Commitment	b	0.47**	0.05	0.33*	0.18	0.47**	0.24**
	ß	0.45**	0.04	0.23*	0.14	0.43**	0.39**
Municipality	b	0.47**	0.17	0.06	0.98**	-0.16	0.12
	ß	0.26**	0.09	0.03	0.44**	-0.09	0.11
CMZ	b	0.11	0.46*	0.44	-0.05	-0.05	0.25*
	ß	0.07	0.28*	0.21	-0.03	-0.03	0.29*
Hazard experience	b	0.11	0.14	0.23	0.08	0.42**	0.04
	ß	0.07	0.08	0.10	0.04	0.25**	0.04
Floodplain area	b	0.00	0.01**	0.01**	0.01**	0.01**	0.00
	ß	0.07	0.33**	0.26**	0.31**	0.20**	0.06
Surge risk area	b	-0.00	-0.00	-0.00	0.00	-0.00	-0.00*
	ß	-0.13	-0.15	-0.17	0.15	0.01	-0.29*
Population	b	-0.00	0.00	0.00	0.00	0.00	0.00
	ß	-0.077	0.06	0.02	0.03	0.08	0.03
Population change	b	0.01**	-0.00	0.00	0.00	-0.00	0.00
	ß	0.22**	0.01	0.01	0.10	-0.11	0.02
Constant	b	0.66	-0.21	-0.02	0.42	0.01	-0.06
R^2		0.364**	0.281**	0.248**	0.528**	0.503**	0.249**

N= 124; **p* ≤ 0.05, ***p* ≤ 0.01, All test one-tailed for capacity and commitment, two tailed otherwise

Table 6.2 OLS regressions between 12 indices of dependent, independent and control variables (continued)

Dependent		(7) Federal incentives	(8) Financial tools	(9) Property acquisition	(10) Critical public-private facilities	(11) Public-private initiatives	(12) Professionals for building mitigation
Capacity	b	0.49**	-0.12	0.24*	0.01	0.12	0.16
	ß	0.36**	-0.17	0.25*	0.01	0.12	0.12
Commitment	b	0.09	0.28**	0.24*	0.63**	0.22*	0.37**
	ß	0.06	0.41**	0.25*	0.49**	0.23*	0.28**
Municipality	b	0.10	0.19	0.21	0.56**	-0.01	0.35
	ß	0.04	0.16	0.13	0.26**	-0.00	0.16
CMZ	b	0.05	0.11	0.13	0.03	0.16	-0.10
	ß	0.03	0.11	0.10	0.02	0.16	-0.05
Hazard experience	b	0.31	0.25*	0.22	0.41*	0.35*	0.29
	ß	0.15	0.24*	0.15	0.21*	0.24*	0.15
Floodplain area	b	0.01	0.00	0.00	-0.00	-0.00	0.01**
	ß	0.13	-0.01	0.05	-0.03	-0.06	0.35**
Surge risk area	b	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00
	ß	-0.10	-0.09	-0.22	-0.11	-0.10	-0.07
Population	b	0.00	0.00	0.00	0.00	0.01	0.00
	ß	0.04	0.03	0.08	-0.00	0.04	-0.04
Population change	b	-0.00	-0.00	-0.00	0.01	-0.00	0.00
	ß	-0.05	-0.06	-0.09	0.14	-0.10	0.11
Constant	b	1.22	-0.53	-0.21	-0.54	-0.39	-0.27
R^2		0.271**	0.197**	0.318**	0.370**	0.257**	0.348**

N= 124; $^*p \leq 0.05$, $^{**}p \leq 0.01$, All test one-tailed for capacity and commitment, two tailed otherwise

Focusing on the three models where capacity has statistically significant effects, these findings also indicate that increasing community capacity leads to the adoption and more extensive usage of building standards for new and existing structures, and increase the participation of the National Flood Insurance Program (NFIP) and the Community Rating System (CRS). In addition, local jurisdictions that have more capacity tend to adopt and employ to a greater extent property acquisition programs such as fee simple purchase, acquisition of development rights or easements, and relocation of existing buildings. This result is consistent with correlation analysis results showing positive correlation between capacity and building standards, federal incentives, and property acquisition. As noted above, is the most important predictor of participation in federal programs, is tied for the most important in the property acquisition model, and is second in the building standards model.

Conversely, Table 6.2 also suggests that capacity does *not* have a statistically significant effect in the remaining nine models. Specifically, capacity is not significant in the models for development regulations, shoreline regulations, natural resource protection, information dissemination, local incentives, financial tools, critical public and private facilities, and hiring professionals for building mitigation. These findings suggest that an increase in capacity might not increase the adoption of these policies.

6.2.2 Commitment

Jurisdictional commitment has a significant and quite positive effect in 9 out of the 12 models. Specifically commitment is statistically significant in models predicting land use and development regulations, natural resource protection, information dissemination, local incentives, financial tools, property acquisition, public and private critical facilities regulations, public and private initiatives, and the hiring of professionals. These results clearly suggest that local jurisdictions with stronger commitment were likely to use development regulations such as residential subdivision ordinances, plan unit development, hazard setback ordinances, and other zoning regulations. In addition, the more commitment is present within local jurisdictions, the more likely they disseminate information such as public education seminars and hazard disclosure to a very great extent. Although the R^2 for financial tools is smaller than the R^2 for information dissemination, the finding remains consistent with the expectation that higher levels of commitment in local jurisdictions will also increase the adoption of financial tools such as lowering tax rates and special tax assessments for avoiding hazardous areas. Further, higher commitment in local jurisdictions leads to more extensive use regulations that require locating public and private facilities in safer places. These findings also suggest that local jurisdictions with higher commitment levels are likely to use more local incentives such as transfer development rights and density bonuses. In addition, local jurisdictions with the stronger commitment levels tend to increase the practice of hiring consultants to identify suitable building sites and develop special building techniques for hazard prone areas. These findings suggest that local jurisdiction commitment increases the extent to which natural resource protection strategies such as wetlands and habitat protection, as well as protected areas conservation, are implemented. In addition, commitment is associated with significant increases in the use of building codes and policies for new and existing homes. Local jurisdictions that have more commitment also tend to employ more acquisition programs and have public-private partnerships within their communities.

These results support other research that states commitment plays an important role for coastal jurisdictions to adopt natural resource protection for reducing disaster risks by acquiring property for public benefit (Norton, 2005; Tang, 2008). In addition, local jurisdictions that have more commitment have more public–private sector initiatives for specific coastal regions. It is interesting to note that many of the models in which commitment is significant, with the possible exception of hazard education and communication programs, are generally policies that are not especially prevalent or even popular among Texas jurisdictions. The simple fact is that tax programs, zoning in general, property acquisition, public/private initiatives, as seen in Chapter IV, are all unpopular among Texas jurisdictions so it takes extra levels of community commitment to employ these kinds of programs more extensively. Clearly, this finding is consistent with the literature that, without extraordinarily commitment on the part of a jurisdiction, it is very difficult to advance programs that are generally shunned by many powerful local stakeholders.

On the other hand, local jurisdiction commitment is not a strong factor in implementing shoreline regulations and federal incentives. These findings are contradictory to what was expected, but are consistent with the correlation analysis result showing that there is no positive correlation between commitment and shoreline regulations. Local jurisdictions in coastal areas that have stronger commitment levels are expected to limit and restrict development on the shoreline as well as protect dune and coastal vegetation.

In addition, increasing commitment in coastal communities was expected to increase the use of federal incentives. However, empirical support for this hypothesis cannot be found because federal incentives are widely employed by all Texas coastal jurisdictions. Because everyone is already employing and embracing these programs, as was shown in Chapter IV, commitment is not a determining factor here. Rather, factors like simple capacity are driving how extensively communities are employing these policies. Similarly, shoreline regulations are already driven by federal policy, hence local commitment is less important.

In general, compared to capacity, it seems that local jurisdiction commitment is a consistently significant and positive effect for a larger array of hazard mitigation polices, many of which are not generally pursued by jurisdictions throughout the Texas coast.

6.2.3 Jurisdiction type

It was expected that municipalities would more extensively employ hazard mitigation policies than counties because the former have much greater legal capacity to undertake a host of regulations, ordinances, and policies. The results suggest that the municipality indicator is statistically and positively significant in three models. Specifically, municipality is positively significant in the development and land use regulation model, the building standards model, and in the critical public/private facilities regulation model. These findings suggest that coastal municipalities are likely to make more efforts in adopting residential subdivision ordinances and other development regulations, in utilizing extensive building codes and regulations for new and existing homes, and in requiring critical facilities to be relocated in safer areas as compared to coastal counties.

6.2.4 Jurisdictions located in the Coastal Management Zone (CMZ) area

It is perhaps not surprising that CMZ jurisdictions employ mitigation policies and strategies more extensively. However it is perhaps surprising that this is only significant in two models—the models predicting shoreline regulations and local incentives. These results clearly suggest that the local jurisdictions located within the CMZ area tend to put more effort into limiting and restricting development on shorelines and employing dune and coastal vegetation protection regulations. This result is clearly not all that surprising. Additionally, these jurisdictions tend to enact more local incentives such as cluster development and transfer development rights that are useful for discouraging development in environmentally sensitive/hazardous areas. Given that these jurisdictions are likely to be located in very high hazard areas, the fact that these jurisdictions are employing these more innovative measures is encouraging. However, CMZ jurisdictions are not making more extensive use of other types of hazard mitigation policies. Specifically location in the CMZ is not significant in models predicting the extensiveness of usage of development regulations, natural resource protection, federal incentives, financial tools, property acquisition programs, and public-private initiatives.

6.2.5 Hazard experience

The findings in Table 6.2 suggest that there are a variety of results among hazard experience in influencing the extent to which local jurisdictions employ hazard mitigation policies and strategies. Surprisingly, hazard experience has no significant effect on the majority of the 12 models. Hence, damages experienced by coastal communities in the past ten years are is statistically significant in three models- the models predicting information dissemination, financial tools, critical public-private facilities and public-private initiative. These findings lend further support to previous studies that state that local jurisdictions that experience the impact of coastal hazards tend to have more outreach programs to educate the public about high-hazard risks and encourage their communities to have more proactive measures such as seminars and workshops for builders and developers as well as provisions of hazard disclosure and hazard zone signs (Burby and Dalton 1998; Laurian, 2006). In addition, the more impact they experience from coastal hazards, the more cities and counties put efforts into providing their communities with lower tax rates, impact fees, and special tax assessments. Moreover, local jurisdictions that experienced losses in the past decade will put more effort in having public private initiatives.

However, it is surprising that hazard experience in the past 10 years is not statistically significant in models predicting development regulations, limited shoreline development and regulations, natural resource protection, building standards, local incentives, and hiring professionals for building mitigation. These findings clearly suggest that Texas coastal jurisdictions that experienced damage from coastal hazards do not extensively employ mitigation policies and strategies. Some explanations include: first, these jurisdictions may not have the capacity to introduce stricter development regulations and may have fewer resources to support local incentives or hiring consultants to identify suitable building sites and develop special building techniques. Second, local jurisdictions that have experienced previous natural hazards are mostly in the coastal areas, where the population is growing and causing a high degree of demand for land in environmentally sensitive or hazardous areas and this, in turn, creates inherent conflicts of interest. As a result, these local jurisdictions might be less likely to adopt policies, such as natural resource protection and shoreline regulations, that require significant resources to enforce.

6.2.6 Floodplain areas

The finding in Table 6.2 suggest that floodplain area has a significant and positive effect in five out of the 12 models predicting the extensiveness to which specific sets of hazard mitigation policies and strategies are being employed, the most among control variables. More specifically, the findings indicate that floodplain areas has a positive effect on the extent to which shoreline regulations, natural resource protection, building standards, information dissemination, and hiring professionals for building mitigations are being employed.

These results suggest that local jurisdictions with a high percentage of floodplain areas devote more effort to restricting and limiting development in shoreline areas and also adopt regulations that protect dunes and coastal vegetation. Additionally, local jurisdictions with a high percentage of floodplain area tend to put more efforts into wetland and habitat protection as well as protected areas regulations. These findings also suggest that local jurisdictions with larger floodplain areas are more likely to adopt building codes for new and existing buildings. Since they have a larger risk of experiencing flooding, they are also likely to hire more consultants to help them identify suitable building sites and develop special building techniques in the hazard prone areas. In addition, jurisdictions with larger floodplain areas also tend to put more effort into raising hazard awareness within their communities by increasing public education programs, conducting more seminars or workshops on hazard mitigation for builders and developers, and providing hazard disclosure and hazard zone signs.

Interestingly, floodplain area is not significant in models predicting the extensiveness of usage of critical public and private facilities and public- private initiative. These findings suggest that local jurisdictions with larger floodplain areas fail to making more extensive use of policies to direct critical infrastructure development away from hazardous areas to adopt policies such as land trusts and public-private partnerships.

6.2.7 Strom surge areas

It was hypothesized that storm surge risk area, like floodplain area, would have a significant positive effect on local jurisdictions' implementation of hazard mitigation policies and strategies. However, it is surprising that storm surge has only one statistically significant effect in the 12 models—and the effect is negative. More specifically, the findings indicate that storm surge area has a negative effect on the extent to which local incentives programs are being employed.

This result suggests that local jurisdictions with a larger percentage of their community located in storm surge risk areas are less likely to provide local incentives, such as a density bonus and transfer development rights, to keep development from these high risk and environmentally sensitive areas. This finding was unforeseen. However, upon reflection perhaps it can be explained due the fact that local incentives, such as transfer development rights, are a complex mechanism to implement (Beatley, 2009; Schwab et al., 2007) and perhaps most importantly, local incentives programs may also be expensive policies for local jurisdictions in Texas with its legal environment. Property directly on the coast can be extraordinarily expensive and, given Texas's penchant to hold property rights above all others, quite difficult to deal with when it comes to implementing density bonus policies and transfer programs. Thus, communities with higher levels of storm surge risk zones also contain prime coastal properties that are highly valuable resulting in developers and landholders seeking to maximize the development potential and value, making it increasingly difficult to make use of local incentives programs. In short, jurisdictions that have high surge vulnerability might have higher development pressure because they are on the coast and in Texas' legal environment are less likely pursue local incentive programs.

6.2.8 Population

Jurisdictions with larger population are expected to more extensively employ policies and strategies to carry out hazard mitigation in coastal areas. However, it is unanticipated that population is not statistically significant in 12 models predicting the extensiveness to which specific sets of hazard mitigation policies and strategies are being employed by local jurisdictions. The results suggest that jurisdictions with a larger population are not extensively employing hazard mitigation policies and strategies. The most reasonable explanation is that population size may simply has no direct effect on policy adoption.

6.2.9 Population change

Similarly, local jurisdictions with the higher percentage of population change are expected to more extensively employ mitigation policies and strategies. However, population change is only significant in two models out of 12 models—the ones predicting development regulations and critical public and private facility location.

These results suggest that local jurisdictions with greater population growth tend to put efforts in enacting regulations such as residential subdivision ordinances, plan unit development, and other development regulations. These findings support previous studies on plans evaluation indicating that a faster change in population provides more pressure and affect the commitment of local governments in using various types of development policies (Tang, 2008). Additionally, these results suggest that local jurisdictions with rapid population growth devote efforts to more extensively use regulations that require locating public and private critical facilities and infrastructure in safer places or to be built away from potential impacts of hazards. This can be understood in that local jurisdictions' main goal on coastal hazard mitigation is reducing loss and disturbance during the hazard event (Burby, 1998; Godschalk et al., 1999).

However, local jurisdictions that have greater population growth are not making more extensive use of other types of hazard mitigation policies. Specifically, population growth is not significant in models predicting the extensiveness of usage of shoreline regulations, natural resource protection, building standards, local incentives, and hiring professionals for building mitigation. Although population growth is expected to have a significant effect on the 12 indices of land use and development regulations, the results support the previous studies in that there are inconsistencies in the influence of population growth on the usage of hazard mitigation policies and strategies (Kang, 2009; Tang, 2008).

6.2.10 Modeling the extent to which non-structural hazard mitigation policies are employed by coastal communities: the composite index for non-structural hazard mitigation

Table 6.3 displays the results of the final model considered in this dissertation in which the composite dependent variable comprised of the 12 indices of non-structural hazard mitigation policies and strategies is the dependent variable. This measure is designed to provide an overall assessment of the extent to which various forms of non-structural hazard mitigation policies and strategies are being employed by coastal jurisdictions. The composite hazard mitigation policy index was regressed on the same set of variables employed in previous models: capacity, commitment, and contextual factors including hazard experience, population in 2009, population change from 2000-2009, floodplain area, surge risk area, CMZ area, and jurisdiction type.

This model accounts for 57% of the variance in the hazard mitigation policy index. Based on the R^2, this final model is the best model of the 13 for predicting the extensiveness to which hazard mitigation policies and strategies are employed. Controlling other variables, capacity has a statistically significant effect on the extensiveness of usage of hazard mitigation policies. This finding supports the main research hypothesis (Hypothesis 1) that increasing local jurisdiction capacity will lead to more extensive use of hazard mitigation policies and strategies. This result suggest that local jurisdictions capacity in the form of staff, support within jurisdictions, support from stakeholders on general planning, budget availability, financial resources, and data will put more efforts in employing hazard mitigation policies and strategies. This result supports previous research in that capacity plays a significant role for hazard mitigation, such as flood mitigation in Florida and Texas (Brody et al., 2010), and studies on plans quality for tsunami mitigation in the Pacific areas (Tang et al., 2011).

Table 6.3 Results from ordinary least squares (OLS) regression on hazard mitigation policies in Texas coastal areas

Independent variables	**b**	**β**
Capacity	0.144*	0.194*
Commitment	0.296**	0.407**
Municipality	0.253**	0.204**
CMZ	0.127	0.126
Hazard experience	0.238**	0.213**
Floodplain area	0.005**	0.237**
Surge risk area	-0.002	-0.147
Population 2009	0.000	0.029
Population change	0.001	0.033
Constant	0.005	
$R^2 = 0.57^{**}$		
N = 124		

*$p \leq 0.05$, **$p \leq 0.01$, All test one-tailed for capacity and commitment, two tailed otherwise

However, community commitment has an even stronger positive impact on the extensiveness of usage of hazard mitigation policy. This result supports the second main research hypothesis (Hypothesis 2) in that the stronger the local jurisdiction commitment, the more extensively hazard mitigation policies and strategies are employed. The finding suggests that the increasing commitment in coastal communities, which is indicated by having more agreement with other stakeholders, having more involvement with agencies within their jurisdictions as well as agencies at the state level, and also having staff that allocate more time for hazard planning, will affect in the extensiveness to which hazard mitigation policies and strategies are employed in their respective jurisdictions.

Interestingly, commitment has more important relative effect than capacity and any other independent variable in the model, as assessed by the standardized coefficient ($\beta = .41$), which is twice the size of the standardized coefficient for capacity. This is consistent with the literature stating that commitment is more of an action oriented performance to achieve institutional goals (Godschalk et al., 2000; Norton, 2005). In other words, simply having capacity is not enough for coastal communities to reduce any impact of hazards if they have little or no willingness to work with other stakeholders or be involved with other agencies within their jurisdiction as well as with state level agencies, particularly if local jurisdictions lack staff that devotes their time to hazard mitigation planning. It is also possible that stronger commitment may drive local jurisdictions to increase their capacity, meaning that they can make the best use of the resources they have and expand their ability to reach the goal of reducing any impacts of coastal hazards.

The findings presented in Table 6.3 also indicate that, when considering only the control variables, municipality has the strongest influence on the implementation of hazard mitigation policies. This result suggests that Texas coastal municipalities are more extensively employing non-structural hazard mitigation policies and strategies than counties. This result is expected, as municipalities in Texas are the only political entities with home rule—which gives them greater powers to enact, implement, and enforce hazard mitigation policies and strategies. Indeed, even smaller communities that have not adopted home rule have the ability to adopt city ordinances, rules, and regulations (Texas Municipal League, 2011) that can be directed toward reducing hazard impacts. This result is consistent with the descriptive and correlations analyses presented in previous chapters and supports the hypothesis (H_3).

Contrary to expectation, the location of jurisdictions in the CMZ area has no significant effect on hazard mitigation policies. This result indicates that jurisdictions located in the CMZ area are not more extensively employing hazard mitigation policies and strategies—a result that conflicts with previous studies reporting that jurisdictions located in coastal areas tend to put more effort into coastal land use planning (Norton, 2005b; Tang, 2011). Additionally, Godschalk et al. (1989) found that communities in Gulf and Atlantic coast area were more likely to be successful in the adoption of development management for storm hazard reduction.

On the other hand, the results show that hazard experience influences the use of hazard mitigation policies and strategies as expected. This finding suggests that local jurisdictions that experienced damages from coastal hazards in the past ten years, were likely to more extensively employ hazard mitigation policies and strategies. This result supports the previous research suggesting that the recent hazards experience or damages suffered from recent coastal hazards influence local jurisdictions in adopting development regulations and mitigation policies (Burby & Dalton, 1994; Godschalk et al., 1989; Lindell et al., 2006).

Also as expected, floodplain area has a strong positive effect on the adoption of hazard mitigation policies, which indicates that local jurisdictions with a higher percentage of floodplain area are likely to put more effort in employing hazard mitigation policies and strategies. This result is contrary to a previous finding suggesting that the percentage of floodplains within a local jurisdiction does not significantly correlate with non-structural mitigation techniques (Brody et al., 2010).

Unlike floodplain area, storm surge risk area does not have a significant effect on the use of hazard mitigation policies. This result does not support the expectation that local jurisdictions with a higher percentage risk of storm surge will adopt more policies that can reduce any impact of coastal hazards, particularly hurricanes and storm surges. However, it is consistent with a previous finding that areas subject to hazards had lower plan quality (Berke et al., 2009). The common argument used is that communities with large areas subject to hazards are not likely to restrict development in the hazardous area since such restriction may cause rapid escalation of land and housing costs in remaining areas suitable for development (Berke et al., 2009). However, it is unclear why the result for storm surge risk area is different from the result for floodplain area. One possible explanation is that the jurisdictions with high levels of storm surge risk area are located directly on the coast, so they might be subject to more intense pressures by land developers.

In regard to population characteristics, the findings in Table 6.3 show that population and population change unexpectedly lack any influence on the use of hazard mitigation policies and strategies. However, this is not completely surprising because previous studies have shown inconsistencies in the reported effects of population on the implementation of hazard mitigation policies. Burby and Dalton (1994) found that population was a strong factor associated with the adoption of measures to limit development of hazardous area. In addition, Godscalk et al. (1989) found that population size had a positive influence on the adoption of storm hazard mitigation measures.

However, other researchers found non-significant effects of population and population growth on local jurisdictions' adoption of hazard mitigation policies and plan quality (Brody, 2003; Kang, 2009; Norton, 2005b; Tang, 2011). This may be due to the fact that larger populations and the rapid change in population cause a high demand for land in the coastal regions. Thus, local jurisdictions tend to be reluctant to adopt any policies that may cause conflicts and require a lot of resources. This supports Burby and Dalton's (1994, p. 234) statement "the more dependent communities are on hazardous areas for growth and development, the less feasible are land use solutions".

From Table 6.3, it can be seen that there are distinct differences in the importance of these variables as indicated by the size of their standardized regression coefficients. Commitment (.41) has the strongest effect on the use of hazard mitigation policies and strategies, followed by floodplain area (.24), hazard experience (.21), municipality (.20), and capacity (.19). These findings suggest that commitment is of paramount importance, followed by risk and experience, legal capacity, and then capacity itself.

6.3 Summary

This chapter has examined factors that influence the extent to which local jurisdictions in Texas coastal areas employ hazard mitigation policies and strategies. The key findings of this chapter are summarized below.

First, commitment is the most important factor in influencing the extensiveness use of hazard mitigation policies and strategies. The results suggest that local jurisdictions with stronger commitment levels will be more likely to employ hazard mitigation policies and strategies to reduce losses and damages from coastal hazard.

Second, floodplain area is the second most important factor predicting the extensiveness to which hazard mitigation policies and strategies are being employed. The results suggest that coastal communities with a higher percentage of floodplain area will be more likely to adopt and use hazard mitigation policies and strategies.

Hazard experience is the third important factor that influences the extent to which local jurisdiction employ hazard mitigation policies and strategies. The results suggest that local jurisdictions experiencing greater levels of damage in the past 10 years are more extensively employing hazard mitigation policies and strategies. Fourth, municipality is also a significant predictor of the use of hazard mitigation policies and strategies. The results suggest that municipalities are more likely than counties to extensively employ hazard mitigation policies. In addition, capacity is the fifth important factors in influencing the extensiveness usage of hazard mitigation policies and strategies. The findings suggest that local jurisdiction with larger capacity are likely more extensively use policies and strategies. Last, the CMZ area, storm surge area, population and population change are not statistically significant factors in influencing the extensiveness of usage of hazard mitigation policies and strategies.

Overall, among all factors that influence to the extensiveness of usage of hazard mitigation policies and strategies, commitment is the most powerful predictor. Hazard experience is the second most important factor predicting the extensiveness of the adoption and implementation of hazard mitigation policies and strategies.

CHAPTER VII

DISCUSSION AND CONCLUSIONS

Previous research related to non-structural forms of hazard mitigation have tended to focus on plan evaluation to assess what factor shape the quality of these plans for potentially reducing the impacts of natural hazards (Berke, 1998; Brody & Highfield, 2005; Burby, 1998; Burby and May, 1998; Tang et al., 2008). Few empirical studies have directly investigated the extent to which land use policies and strategies are implemented or the factors that may influence the implementation of these policies. Therefore, this research addresses a critical gap in the planning and hazard literature by examining these issues. Descriptive statistics, correlation analysis, and multivariate regression were applied to examine not only the extensiveness of usage a variety of non-structural hazard mitigation policies and strategies, but also factors that influence the extent to which Texas coastal counties and municipalities utilize those policies and strategies.

7.1 Summary of key findings and discussion

Results from all phases of the analysis lead to topics that are worthy of further discussion. The key findings regarding the first research objective, which was to examine the extent to which local jurisdictions adopt and employ non-structural hazard mitigation and policies, are discussed below.

First, of the 44 non-structural hazard mitigation policies and strategies studied, the top three—on a scale from not employed at all (= 0) to employed extensively (= 3) are 1) participation in the National Flood Insurance Program (2.35), 2) the use of subdivision ordinances (2.34), and 3) flood standards for buildings/homes (2.30). When considering the top ten policies among coastal jurisdictions, five are related to building codes, two are federal incentive programs, and three are land use/development regulations. Meanwhile, the least utilized of these tools include density bonuses, special taxing districts, impact fees, cluster development, lower taxes for environmental protection, and transferring development rights which all have means less than 0.2 on a 0-3 scale. On the whole, the portfolio of hazard mitigation strategies and policies is quite limited among Texas jurisdictions

These results partially support Klee's (1999) statement that the most often used tools for coastal planning at the local level are traditional zoning practices, urban growth boundaries, building codes, and setback requirements. In addition, this finding supports previous studies that building standards have been increasingly used by local governments as tools to mitigate natural hazards (Olshansky & Kartez, 1998), particularly in coastal areas where development cannot be avoided (Beatley, 2009). However, this finding is inconsistent with Olshansky and Kartez's (1998, p. 167-168) suggestion that, after the 1970s, many local governments have moved beyond zoning and subdivision regulations as well as traditional capital investments and have added more techniques and instruments that can work in tandem with conventional regulations, particularly in mitigating losses from natural hazards. On the other hand, the findings are consistent with other studies that found activities involving finances tend to be overlooked as they have bigger consequences for local jurisdictions, particularly for small governments (Beatley, 2009; Schwab et al., 2007). As is the case here, Tang et al.

(2011) found that financial tools have been minimally used in local coastal land use planning efforts.

Second, among Texas jurisdictions there are considerable differences between municipalities and counties in the implementation of a variety of non-structural hazard mitigation policies and strategies. Municipalities tend to put more effort in employing building standards and development regulations, whereas counties more extensively employ information dissemination and private-public sector initiatives. An obvious explanation for this difference is that Texas municipalities have more power to regulate land development. For instance, municipalities employed building codes to ensure the safety of their communities as well as ordinances such as residential subdivisions and hazard setbacks that can help to steer development away from the hazardous or environmentally sensitive areas (Burby & May, 1998). In other words, land use regulations and building codes lie more clearly within municipality government authority, particularly in municipalities with home rule that gives cities complete political control over their jurisdiction and budget (Texas Municipal League, 2011). Although some counties in Texas have the ability to enact laws, the power is limited as counties “cannot pass ordinances unless specifically authorized by the state” (Maxwell et al., 2010, p. 416). However, counties tend to have more resources than cities. Thus, they are more confined to a limited range of policies such as employing more programs on disseminating information and advancing initiatives with private sectors, which do not require ordinances to implement.

Third, there are no significant differences between municipalities and counties in adopting shoreline regulations, natural resource protection, property acquisition programs, local incentives tools, financial tools, critical public-private facilities relocation, and hiring professionals for building mitigation. Neither municipalities nor counties put much effort into using these policies to mitigate coastal hazards.

Overall, coastal communities in Texas are employing a very limited set of land use and development regulations that the literature has identified as important for hazard mitigation. This inattentiveness of coastal communities to land use and development regulation may be due in part to the absence of a state mandate (Burby, 1998). It may also be due to the fact that some jurisdictions have a very sparsely populated area and less population concentrated in environmentally sensitive or hazardous areas. Thus, there is no pressure to provide safety for its communities through land use regulations.

The second objective of this research is to examine factors that influence the extent to which coastal counties and municipalities in Texas utilize non-structural hazard mitigation policies. This objective focuses on the capacity and commitment of local jurisdictions, which are considered key indicators that influence the adoption and implementation of hazard mitigation policies and strategies in the literature. Other factors that may also influence the extensiveness of usage these policies include jurisdiction type and location in the CMZ area, hazard experience and hazard exposure consisting of the percentage area in a 100-year floodplain, storm surge zones, population size in 2009, and population change from 2000-2009. This study found some valuable results that provide important insights about how these factors influence the adoption and implementation of policies and strategies that are important for hazard mitigation in Texas coastal areas.

First, the main hypotheses of this study were supported. Local jurisdictions that have a greater capacity are likely to more extensively employ hazard mitigation policies and strategies. This result supports the previous findings that capacity plays a significant role in influencing the adoption of land use and development regulations that are important for hazard mitigation (Brody et al., 2010; Burby, 1998).

Second, commitment is the most important factor in influencing the extent of adoption and implementation of hazard mitigation policies and strategies. This result is also expected, but the results show that commitment is a stronger factor than capacity—especially for policies and strategies that are relatively unpopular or are not extensively used in Texas coastal areas. A possible interpretation of this finding is that local jurisdictions may already have a willingness to implement hazard mitigation and may find ways to reach the objective or "be committed to the goals of the policy" (Norris-Raynbird, 2006, p. 12) even if they have limited capacity. In other words, this finding is consistent with the literature that—in the absence of mandates from higher levels of government— it is very difficult to advance policies and programs without a significant commitment on the part of a jurisdiction.

Third, of the control factors, floodplain area, hazard experience, and municipality, are the ones most strongly associated with the implementation of hazard mitigation policies and strategies. These results are consistent with previous findings that hazard experience and exposures influence local jurisdictions in adopting development regulations and mitigation policies (Burby & Dalton, 1994; Godschalk et al., 1989; Lindell et al., 2006). In regard to jurisdiction type, other research suggests that local officials in beach and inland communities were more committed to planning than were county officials (Norton, 2005b), which implies that coastal cities will be more likely to employ hazard mitigation policies and strategies.

Fourth, population size, population change, and location in the CMZ area, and percentage of the jurisdiction in storm surge risk areas do not have effects on the usage of non-structural mitigation strategies, when considering all policies together. These results are partially consistent with previous findings in which demographic factors such as population and population growth did not influence local jurisdictions' adoption of land use and development regulations (Kang, 2009; Tang, 2008). Conversely, some researchers found that population, indeed, is associated with the adoption of measures to limit development in hazardous areas (Burby & Dalton, 1994). However, population of a jurisdiction and population growth have inconsistent results if these are associated with commitment elected officials committed to hazard mitigation, quality of plans, and constituent demands (Burby & May, 1998). Similarly, there is also inconsistency in the effects of the location of jurisdictions in adopting hazard mitigation policies (Norton, 2005b; Tang et al., 2011). Jurisdictions that are located in the CZM area do not have more extensive use of hazard mitigation policies and strategies. In addition, jurisdictions with a higher percentage of land area in storm surge risk areas are unlikely to employ hazard mitigation policies and strategies extensively, which is partially consistent with the suggestion of Berke et al. (2009) that areas subject to hazards had lower plan quality.

7.2 Theoretical and policy contributions

This study makes some important theoretical contributions to the scholarly literature in planning, public policy, and hazard mitigation research particularly with respect to coastal hazards. First, this study is the first to examine the extent to which local jurisdictions in Texas coastal areas actually adopt and implement hazard mitigation policies and strategies. While most of the previous studies have focused on plan evaluation, this study focuses on local jurisdiction practices in employing non-structural hazard mitigation policies. Thus, the findings provide a deeper understanding of policy adoption and implementation, which may be quite different from the land use or comprehensive plans. Specifically, even high quality plans might not be implemented effectively—or even at all. Thus, this study provides an important supplement to plan evaluation studies by showing that many of the same results are found using the extent to which hazard mitigation policies and strategies have been implemented as the dependent variable.

Second, this study also provides theoretically meaningful results as it adds an important dimension to studies that have mostly focused on state and county government. The present research found that, in a state without planning mandates, municipalities adopt and make more extensive use of policies than county government. This creates a better understanding of the adoption and implementation of non-structural hazard mitigation strategies. In this regard, however, the study found that coastal communities in Texas are employing a very limited set of policies and strategies. Therefore, they need to adopt and more extensively implement different strategies and non-traditional approaches to land use and development regulations in order to reach the goal of hazard mitigation in coastal areas. This is important as municipalities, counties, and special districts are key local players in determining how coastal areas are used (Klee, 1999).

Third, this study adapted a number of measures of local government capacity and commitment from previous research. Specifically, the key components for capacity included the number of staff, training, budget, financial sources, data sources, support from individuals and groups within jurisdictions for hazard mitigation, and support from groups for planning in general. Moreover, for commitment, the key indicators were coordination with other jurisdictions, staff time allocated to hazard mitigation planning, and involvement with other agencies within jurisdictions and agencies at the state level. In other words, commitment was an action based measure, rather than a simple "perceived" commitment measures. In addition, the study found data sources and financial sources are key elements of capacity. Meanwhile, the staff's time that is dedicated to hazard mitigation planning, the willingness to be involved in hazard mitigation planning with other agencies within the jurisdiction and at the state level, as well as formal agreement with stakeholders within the jurisdiction are key elements of commitment. These results add to earlier studies on the importance of examining capacity and commitment for policy adoption and implementation (Brody et al., 2010; Norton, 2005b; Tang et al., 2011). Indeed, capacity and commitment are strong factors that influence the extent to which local jurisdictions are employing hazard mitigation policies and strategies. Planners, city managers, and county judges may improve their institutional capacity building by increasing the utilizations of data sources, financial resources, and training that demonstrates a useful aptitude for hazard mitigation planning. In addition, local jurisdictions may strengthen their commitment by devoting more staff's time to hazard mitigation planning. Furthermore, local jurisdictions may involve other agencies within their jurisdictions as well as those at the state level to reach the objective of mitigation to reduce any impact of coastal hazards, and also work with stakeholders within their jurisdiction such as schools, non-government organizations, faith-based organizations, and environmental groups.

7.3 Research limitations and recommendations for future research

In any research, there are always limitations, and this study is not exempted. Although it provides a more complete picture of the extent to which local jurisdictions are employing hazard mitigation policies and strategies, it has some constraints. First, the response rate for this study was only moderately high (46%). In addition, there are counties in which many of their cities responded to the survey, but there are a few counties in which no municipalities responded. While there is no reason to think that the study results are particularly biased, increasing response rates may well have enhanced findings.

Additionally, the challenges and problems of different sizes of coastal communities in Texas may not be captured by the internet survey. Future studies should add a qualitative survey to obtain additional in-depth information on the process of how local jurisdictions employ hazard mitigation policies and strategies as well as the challenges they face in utilizing these policies. In addition, there are several other questions need to be added in the survey instrument such as whether the planners and city managers monitor and evaluate the implementation as well as information regarding the extraterritorial jurisdiction (ETJ), as cities may enforce zoning and building codes in the ETJ.

Further, future research may also elaborate a comparison of local jurisdictions' adoption of land use and development regulations between the survey and plan evaluations at the same local jurisdictions to examine the plan and the actual implementation of policies and regulations that can enhance coastal hazard mitigations. More specifically, the issue of consistency in planning efforts for implemented policy is an important dimension not included in this analysis. It would be interesting to establish the degree to which existing general and hazard mitigation plans were consistent

Last, since this study was conducted only in Texas, the same instrument should also be used to examine local jurisdictions in other states along the Gulf coast as well as along the Atlantic, Pacific, and Great Lakes coasts to examine the extent to which different hazard mitigation policies and strategies have been implemented as well as to further identify the key factors that are important determinants of the extent to which jurisdictions are employing hazard mitigation policies and strategies.

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APPENDIX A

TEXAS COASTAL HAZARD MITIGATION POLICY SURVEY

The purpose of this survey is to gather information about the types of hazard mitigation policies and actions coastal jurisdictions (e.g., municipalities and counties) in Texas are employing to help reduce their vulnerability to natural disasters such as hurricanes and coastal flooding.

Please answer the following questions to the best of your ability. Most of the questions are factual with the goal of simply collecting the most reliable and accurate information as possible. So, if you need to consult with co-workers regarding some of these questions, please feel free to do so.

Throughout the survey, the questions are being asked with respect to "your jurisdiction." If you are a city official, this refers to your city or municipality. If you are a county official, this refers to the county itself and unincorporated areas under its jurisdiction, not to the cities that may reside in your county.

Section I.

The following section asks some general questions about your jurisdiction and some land-use planning issues.

1. To what extent are each of the following issues considered to be high priorities in your jurisdiction?	Not Important at all	Somewhat Important	Important	Very Important
a. Economic Development				
b. Land Use				
c. Housing				
d. Infrastructure (e.g., water, sewer, electric power				
e. Environmental protection				
f. Disaster reduction				
g. Transportation				
h. Recreation				

2. Does your jurisdiction have a comprehensive or general plan?

a. Yes b. No

3. Does your jurisdiction have it own hazard mitigation plan (not a emergency preparedness plan) or is it participating as part of a county or regional hazard mitigation plan? ***NOTE: If you have more than one, please select all that is applied.***

a. No
b. Yes, stand alone hazard mitigation plan (or hazard mitigation action plan)
c. Yes, part of regional (multi-jurisdictional) hazard mitigation plan (or hazard mitigation action plan)
d. Yes, others___________________________

4. Does your jurisdiction have zoning ordinances?

a. Yes b. No

5. Does your jurisdiction have a building code and if yes, what type of code has been adopted?

a. No
b. Yes, 2009 IRC/IBC
c. Yes, 2006 IRC/IBC
d. Yes, 2003 IRC/IBC
e. Yes, 2000 IRC/IBC
f. Yes, SBC
g. Yes, Others__________________________

Section II. Policy

Questions 6-14 ask about specific policies or actions that jurisdictions may employ in their general planning strategy or for specific hazard mitigation planning. Please indicate how extensively your jurisdiction employs each on the scale ranging from (not at all) through (to a very great extent) with a **(√) or (X)**.

6. To what extent are each of the following issues considered to be high priorities in your jurisdiction?	Not at all	A Small extent	To Some extent	Very great extent	Not Within this jurisdiction's authority
a. Residential Subdivision Ordinances					
b. Planned unit development					
c. Special overlay districts					
d. Agricultural or open space zoning					
e. Performance zoning					
f. Hazard setback ordinances (shoreline, flood plain)					
g. Storm water retention requirements					
h. Environmental impact assessment requirements					
i. Limitation of shoreline development to water-dependent uses					
j. Restrictions on shoreline armoring (e.g., levees, seawalls)					
k. Restrictions on dredging/filling					
l. Dune protection regulations					
m. Wetlands protection regulations					
n. Coastal vegetation protection regulations					
o. Requirements for habitat protection/restoration					
7. To what extent has your jurisdiction used the following *building standards*?					
a. Special local standards for wind hazard resistance for new home construction (e.g. hurricane straps, impact resistant windows, reinforced garage doors)					
b. Special local standards for flooding hazards for new home construction (e.g. home elevation, flood vents, shields)					
c. Special local hazard retrofit standards for existing buildings					
d. Special local utility codes (e.g., raised meters, raised air-conditioner platforms)					
8. To what extent has your jurisdiction used the following *property acquisition programs*?					
a. Fee simple purchase of undeveloped lands in environmentally sensitive/hazardous areas					
b. Acquisition of development rights or easements in environmentally sensitive/hazardous areas					
c. Relocating existing buildings from environmentally sensitive/hazardous areas					
9. To what extent has your jurisdiction used the following *incentive tools*?					
a. Transfer of development rights from environmentally sensitive/hazardous areas					
b. Density bonuses in environmentally sensitive/hazardous areas					
c. Clustered development in environmentally sensitive/hazardous areas					
d. Participation in the National Flood Insurance Program (NFIP)					
e. Participation in the FEMA community rating system (CRS)					
10. To what extent has your jurisdiction used the					

following *financial tools*?					
a. Lower tax rates for preserving environmentally sensitive/hazardous areas as open space or limited development intensity					
b. Special tax assessment for districts for environmentally sensitive/hazardous areas					
c. Impact fees or special assessments for development of environmentally sensitive/hazardous areas					
11. To what extent has your jurisdiction used the following *information dissemination strategies*?					
a. Public education for hazard mitigation (e.g., brochures, posters, public service announcements)					
b. Citizen involvement in hazard mitigation planning (e.g., public hearings, meetings with community groups)					
c. Seminars on hazard mitigation practices for developers and builders					
d. Hazard disclosure requirements in real estate transactions					
e. Hazard zone signs					
12. To what extent has your jurisdiction used the following					
a. Requirements for locating public facilities and infrastructure in less environmentally sensitive/hazardous areas (e.g., capital improvement plans)					
b. Requirements for locating critical private facilities and infrastructure in less environmentally sensitive/hazardous areas					
c. Using municipal service areas to limit development in environmentally sensitive/hazardous areas					
13. To what extent has your jurisdiction used the following *private-public sector initiatives*?					
a. Land trusts for environmentally sensitive/hazardous areas					
b. Public-private partnerships for environmentally sensitive/hazardous areas					
14. To what extent have *geologists, engineers, and other professionals* been employed or worked for your jurisdiction to:					
a. Identify suitable building sites in hazard prone areas					
b. Develop special building techniques for hazard prone areas					
c. Conduct windstorm/roof inspection					

Section III: Hazard Experience

The next two questions ask you to roughly assess about how much damage or how likely your jurisdiction will be impacted by different types of hazards. We realize that you may not be a trained specialist when it comes to these hazards, but we are simply asking you to give your best judgment or assessment. Also, some jurisdictions may not be at risk to some of these hazards, in those cases, simply answer "never."

15. In the past 10 years, how much damage has your jurisdiction experienced from:	Never	Slight	Moderate	Major
a. Flood				
b. Coastal storms (including hurricanes)				
c. Tornados				
d. Hail				
e. Excessive heat				
f. Drought				
g. Wildfires				
h. Thunderstorms				
i. Coastal Erosion				
j. Subsidence				
k. Sea-level rise				
l. Technical hazards (e.g., industrial disaster, dam/levee failure, etc.)				
m. Others (please specify):				

16. In the next 10 years, to what extent do you thing the following hazards impact your jurisdiction?	Not at all	Not Very Likely	Somewhat Likely	Very Likely
i. Flood				
j. Coastal storms (including hurricanes)				
k. Tornados				
l. Hail				
m. Excessive heat				
n. Drought				
o. Wildfires				
p. Thunderstorms				
q. Coastal Erosion				
r. Technical hazards (e.g., industrial disaster, dam/levee failure, etc.)				
s. Subsidence				
t. Sea-level rise				
u. Others (please specify):				

Section IV: Jurisdictional Capacities and Resources

The following questions ask about the capacities and resources your jurisdiction has or might employ for undertaking hazard mitigation planning activities.

17. How would you rate the capacity of your jurisdiction to undertake hazard mitigation planning in the following areas?	Poor	Fair	Good	Very Good	Excellent
a. Budget adequacy					
b. In-house technical expertise (e.g., GIS, water/storm water engineer, building inspector)					
c. Access to senior appointed and elected officials					
d. Enforcement authority					
e. Business communities (e.g., chambers of commerce, small businesses)					

18. Please indicate the general support for hazard mitigation planning exhibited by the following groups in your jurisdiction:					
a. Elected officials					
b. Jurisdiction's staff as a whole					
c. Jurisdiction's planning staff/personnel					
d. Jurisdiction's emergency management staff/personnel					
e. Business communities (e.g., chambers of commerce, small businesses)					
f. Special districts (e.g., independent school district, utility district)					
g. Citizens/general population					

19. Rate the frequency with which any jurisdictional staff/personnel have been able to attend the following training opportunities addressing hazard mitigation issues with the past 3 years.	Not at all	A Small extent	To Some extent	Very great extent
a. Training by FEMA				
b. Technical training for computer programs (e.g. HAZUS, GIS, etc.)				
c. Training by professional association (e.g., American Planning Association, Texas Planning Association, National Emergency Management Association)				
d. Other (please specify):				
20. Please rate the degree to which your jurisdiction has used each of the following *financial resources* for funding hazard mitigation actions and/or for disaster recovery efforts.				
a. Community Development Block Grants (CDBG)				
b. Texas Coastal Management Program Grants (TGLO)				
c. Section 406 Hazard Mitigation Grant Program				
d. Small Business Administration Disaster Assistant Program				
e. Pre-Disaster Mitigation Loan Program				
f. Local jurisdictional funds				
g. Other (please specify):				
21. Please rate the degree to which your jurisdiction uses each of the following *data sources* in map or digital form for general or hazard mitigation planning.				
a. Aerial photos/satellite images				
b. Topographical maps				
c. Jurisdictional land use maps or parcel data				
d. Risk area or hazard zone data (e.g., flood, surge, wind-field)				
e. Sensitive environmental area location maps				
f. U.S. Census data				
g. Population projections from State Demographer or Texas Water Development Board				
h. Economic data (e.g., sales, number of employees)				
i. HAZUS program or output-estimates from that program				
j. Coastal Planning Atlas (coastalatlas.tamu.edu)				
k. Other (please specify):				

Section V. Coordination, Cooperation, and Involvement

We are nearly finished. This is the second to the last section, which asks questions about coordination and cooperation within your jurisdiction as well as between your jurisdiction and others.

22. To what extent have the following individuals or departments been involved in your jurisdiction's hazard mitigation planning?	Not at all	A Small extent	To Some extent	Very great extent	Group/Department Not Present In Jurisdiction
a. Elected officials					
b. City Manager (or City Manager in County)					
c. Public Works/Engineering					
d. Planning/Community Development					
e. Economic Development					
f. Building Department					
g. Emergency Management					
h. Environmental Services					
i. City/County Attorney's Office					
j. County Judge					
k. Housing Department/Authority					
l. Flood administrator					
m. Parks/Recreational Department					

23. To what extent have the following individuals or departments been involved in your jurisdiction's hazard mitigation planning?	Not at all	A Small extent	To Some extent	Very great extent
a. Texas Department of Housing and Community Affairs (TDHCA)				
b. Texas Commission on Environmental Quality (TCEQ)				
c. Texas Department of Transportation (TxDOT)				
d. Texas Water Development Board (TWDB)				
e. Texas State Soil and Water Conservation Board (TSSWCB)				
f. Texas Parks and Wildlife Department (TPWD)				
g. Texas General Land Office (GLO)				
h. Texas Division of Emergency Management (TDEM)				
i. Texas Department of Rural Affairs (TDRA)				
j. Regional Council of Government (COG)				
k. Federal Emergency Management Agency (FEMA)				
l. Other (please specify):				

24. Has your jurisdiction worked with or coordinated with other jurisdictions in your area on hazard mitigation planning issues?

a. Yes　　　b. No

25. Does your jurisdiction have any type of agreements like MOUs or joint aid agreements with the following groups for hazard mitigation planning, or disaster response/recovery efforts?	Yes	No
a. Schools/educational institution		
b. Utilities (e.g., electric power, natural gas, telecommunication)		
c. Health service institution (e.g., hospital, clinic)		
d. Professional associations (e.g., builders, engineers, planners)		
e. Non-profit organization (e.g., Red Cross, Habitat for Humanity, neighborhood)		
f. Church or faith-based organization		
g. Financial institution (e.g., bank, savings, loan associations, insurance)		
h. Hospitality facilities (e.g. hotel/motel, nursery homes)		
i. Other (please specify):		

26. How would you characterize the support the following stakeholders have for general planning activities undertaken by your jurisdiction?

	Strongly Opposed	Opposed	Neutral	Supportive	Strongly Supportive	Group(s) Not Present In Jurisdiction
a. Developers/Realtors						
b. Property/land owners						
c. Hospital/medical industry						
d. Utilities (e.g., electric power, telecommunications)						
e. Financial industry (e.g., insurance, banks,)						
f. Minority organizations						
g. News media						
h. Neighborhood associations						
i. Environmental groups						
j. Religious groups						
k. Other (please specify):						

Section VI. Final Information on Your Jurisdiction

The following four final questions simple asks about your jurisdiction.

27. How many staff members in your jurisdiction are involved in hazard mitigation planning?

28. Please indicate the amount of time per year each of these staff members are is involved in hazard mitigation activities. (For example if you have 4 people involved in hazard mitigation activities, 2 for about 50% of their time and 2 for about 10% of their time enter 2 by 26%-50% and 2 by 0%-10%). Each field must have a response, even if it is 0.

a. 0 % to 20 %	
b. 21 % to 40 %	
c. 41 % to 60 %	
d. 61 % to 80 %	
e. 81 % to 100 %	

29. Please estimate the approximate annual budget your jurisdiction dedicates to hazard mitigation planning:

a. $0–$5,000
b. $5,001–$10,000
c. $10,001–$20,000
d. $20,001–$50,000
e. $50,001–$100,000
f. $100,001–$300,000
g. $300,001 or greater

30. Name of your jurisdiction (city or county name):

Your job title (e.g. city planner, floodplain administrator

VITA

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SUMMARY

Ten years professional experience as a lecturer at Muhammadiyah University of Yogyakarta and currently, a vice chair of Muhammadiyah Disaster Management Center. Interested in environmental hazards planning and emergency management, community development, and public policy. Special interests include gender issues in policy context.

EDUCATION

Ph.D. in Urban and Regional Science, Texas A&M University, College Station, Texas, (2012)

MCP, School of Planning, University of Cincinnati, Ohio, US (2000).
Thesis title: *Micro finance for informal sectors: case studies of Muhammadiyah credit programs.*

Bachelor of English Literature, Faculty of Art and Culture, University of Gadjah Mada, Yogyakarta, Indonesia (1994).
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Kang, J.E., Peacock, W.G, and Husein, R. (2010) An Assessment of Coastal Zone Hazard Mitigation Plans in Texas. *Journal of Disaster Research, 5* (5), 526- 534

Peacock, W.G, Kang, J.E., Husein, R, Burn, G.R, Prater, C., Brody, S.D., and Kennedy, T. (2009) *"An Assessment of Coastal Zone Hazard Mitigation Plans in Texas,* unpublished report prepared for the Texas General Land Office and The National Oceanic and Atmospheric Administration, Hazard Reduction and Recovery Center.

ACADEMIC HONORS (selected)

- Fulbright scholarship, August 2007 – August 2010.
- Landscape architecture and urban planning department head prize, 2011.
- Who's who among students in the US universities, Texas A&M University, 2011