FLOODED WITH COMPLEXITY: DO ORGANIZATIONAL STRUCTURES AND BUDGETARY FLEXIBILITY INFLUENCE NATURAL DISASTER PREPAREDNESS?

by

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ABSTRACT

JOELLEN VICTORIA POPE. Flooded with complexity: Do organizational structures and budgetary flexibility influence natural disaster preparedness? (Under the direction of DR. SUZANNE M. LELAND)

The number of natural disaster declarations in the United States is increasing. Hurricane Katrina alone affected 31 colleges and universities in the areas along the Gulf Coast. Improved preparedness performance in universities and colleges can impact response and recovery effectiveness. This study asks: How does the level of natural disaster preparedness of an institution of higher education (IHE) vary with organizational structural complexity? How does the level of natural disaster preparedness of an institution of higher education vary with its degrees of centralization, red tape, and budgetary flexibility? Using contingency theory and the New Public Management (NPM) perspective, this study uses original survey data merged with secondary data to perform regression analyses to answer these questions. The study finds evidence that preparedness outputs are measured by not one concept but four: exercise and training, internal awareness, external collaboration, and planning. Results include support for the theoretical hypotheses comprising the assertion that red tape is negatively associated with exercise and training performance, while budgetary flexibility and directly integrated coordination are related to improvements in exercise and training performance. However, other measurements of performance do not depend on organizational structure and budgetary flexibility. In addition to theoretical contributions, this research contributes to safety. Students and faculty must feel safe on campus to be able to complete mission-

essential functions, such as researching, learning, teaching, and connecting with the community.

DEDICATION

I want to dedicate my work to my husband Rob and my parents, Liz and Richard. I am very thankful to all of them for their unconditional support even when I wasn't the most pleasant person to be around.

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LIST OF ABBREVIATIONS

BEA	Bureau of Economic Analysis
CEMHS	Center for Emergency Management and Homeland Security
DRU	Disaster Resilient University
EFA	Exploratory Factor Analysis
EOC	Emergency Operations Center
FEMA	Federal Emergency Management Agency
IRB	Institutional Review Board
IHE	Institution of Higher Education
IPEDS	Integrated Postsecondary Education Data System
ML	Maximum Likelihood
NIMAA	National Intercollegiate Mutual Aid Agreement
NCES	National Center for Education Statistics
NPM	New Public Management
NHC	National Hurricane Center
NOAA	National Oceanic and Atmospheric Administration
PDD	Presidential Disaster Declaration
PAF	Principal Axis Factoring
PCA	Principal Component Analysis
PFM	Public Financial Management
TPA	Traditional Public Administration
USGS	United States Geological Survey

CHAPTER 1: INTRODUCTION

Natural disasters of all kinds can occur anytime, anywhere. Between 1953 and February 2017, United States presidents issued 2,288 major natural disaster declarations and 369 emergency declarations (FEMA, 2017). From 1990 to 2016, estimated disaster damage in 2016 dollars topped 650 billion, with nearly 98,000 injuries and 16,000 fatalities (CEMHS, 2017). One of the more notable natural disasters in recent history was Hurricane Katrina. According to the Saffir-Simpson scale, Hurricane Katrina hit land in August 2005 as a Category Three hurricane. Hurricane Katrina affected 1.5 million people, leaving more than 800,000 residents without homes, and the death toll numbered approximately 2,000 people (Haddow, Bullock, & Coppola, 2008).

However, there is more to consider than looking only at issues that face local, state, and federal governments and the general overall response. Hurricane Katrina impacted 31 colleges and universities in the areas along the Gulf Coast (Kapucu & Khosa, 2013), including New Orleans campuses that were forced to close, leaving over 80,000 students displaced (Marklein, 2005). Universities and colleges face unique challenges during natural disasters that test an organization's abilities to adapt.

While it is difficult to study organizations during disasters, their natural disaster preparedness can be examined when there is no emergency. Contingency theory suggests that organizational design and structure depend on the environmental conditions in which the organization is situated (Donaldson, 2001; Hult, 2012; Lawrence & Lorsch, 1967;

Scott & Davis, 2006; Stazyck & Goerdel, 2011). Natural disasters are an external product of the environment in which a higher-education institution exists. This study examines whether universities and colleges that successfully adapt their internal organizational structure to these external threats will more effectively perform emergency preparedness tasks. In addition, the New Public Management (NPM) perspective includes the idea of applying private-sector techniques, such as managerial theory, to public organizations (Christensen & Laegreid, 2011; Hood 1991). I examine whether allowing managers allocative discretion over budgetary resources offers a reliable performance indicator for better natural disaster preparedness.

1.1 Problem Statement

There are over 4,000 higher-education institutions in the United States (Kapucu & Khosa, 2013). A university can be thought of as a separate entity with special considerations and problems. University campuses have a different type of special population to consider. If a disaster were to occur, residential students may depend heavily on the university for food, shelter, and other necessities. Also, under certain circumstances (such as Hurricane Katrina), universities can be called upon to play a role in providing resources for not only students but also disaster victims from the community (Kapucu & Khosa, 2013). Given the unique circumstances in which universities find themselves, preparedness for natural disasters is an important consideration.

In addition to the magnitude of the problem are issues of saliency. Natural disasters can be sudden and unpredictable watershed events that immediately influence setting the institutional agenda for policymaking. Such sudden and costly focusing events can generate more attention to the policy problem of preparedness for natural disasters

(Birkland, 1997, 2006). However, once time passes without another natural disaster, the policy problem backslides to predisaster importance (Kettl, 2013).

1.2 Statement of Purpose

The purpose of this mixed-methods study is to examine how organizational structural complexity affects natural disaster preparedness performance at American universities and colleges. A related purpose of this research is to build a scale based on output activities related to natural disaster preparedness. I use institutionalism, organization theory, and the NPM perspective as a framework on which to build the analysis in this study. Since natural disasters and other threats to safety are increasing, universities and colleges are of great concern due to their vulnerability. According to Lawrence and Lorsch (1967), complexity includes both vertical differentiation, the assignment of work in an organization's hierarchy, and integration, the quality of collaboration among departments and layers of an organization. This study also includes the structural aspects of centralized decision-making and red tape. Centralization of decision-making is an important determinant of organizational effectiveness (Gulick & Urwick, 1937; Lægreid & Verhoest, 2010; Weber 1947).

1.3 Research Questions

This study asks the following questions:

Q1. How does the degree of natural disaster preparedness of an institution of higher education (IHE) vary with organizational structural complexity?

Q2. How does natural disaster preparedness performance in institutions of higher education vary with the centralization of decision-making, red tape, and budgetary flexibility?

1.4 Overview of Methodology

In this study, I use a mixed-methods approach. The main instrument for collecting necessary data was a survey. To design a reliable and accessible survey, I conducted semistructured interviews with university representatives responsible for natural disaster preparedness. I distributed the survey to universities and colleges across the United States. The survey consisted predominantly of scaled and quantitative questions, which I analyzed using exploratory factor and regression analysis. The survey also contains open-ended questions to capture more in-depth information that may explain results.

I carried out an online survey to gather information about the link between organizational structure and natural disaster preparedness. The target population was institutional professionals who have knowledge about IHE natural disaster preparedness. Survey requests included emails to a list of university and college emergency managers and posts to the Disaster Resilient Universities (DRU) Network listserv. A scale of preparedness outputs, such as updated plans and amount of training, measured natural disaster preparedness. Questions included inquiries about how well the university performed in a natural disaster. I matched these data with demographic data from the Carnegie Classification of Institutions of Higher Learning. Data analysis comprised factor analysis and linear regression.

1.5 Rationale and Significance

The findings of this research not only test theories but also benefit university and college administrators in the United States. First, this research contributes to contingency and public-managerial theory by testing the effects of organizational structure and flexibility on organizational performance of natural disaster preparedness. Second, it

updates overall assessments of how well American IHEs have prepared for natural disasters. Finally, the study considers whether organizational design affects how well universities have prepared for natural disasters. With this information, universities and colleges can strategically structure their emergency management unit and implement adaptive measures to meet the institution's preferred level of preparedness for natural disasters.

1.6 Terminology

I use the following definition of emergency preparedness: "all those activities and measures designed or undertaken to prepare for or minimize the effects of a hazard upon the civilian population, to deal with the immediate emergency conditions which would be created by the hazard, and to effectuate emergency repairs to, or the emergency restoration of, vital utilities and facilities destroyed or damaged by the hazard" (FEMA, 2013, p. 59).

I define natural disasters as "any hurricane, tornado, storm, flood, high water, wind-driven water, tidal wave, tsunami, earthquake, volcanic eruption, landslide, mudslide, snowstorm, drought, fire, or other catastrophe in any part of the United States which causes, or which may cause, substantial damage or injury to civilian property or persons" (FEMA, 2013, p. 59).

I define organizational structure as the dimensions of an organization that dictate how tasks are divided, determine who does what and how, and serve as the connective fiber that controls members' behavior (Bowditch & Buono, 2005; Egeberg 2012; Scott, 1981). The dimensions of organizational structure include complexity, centralization, and red tape.

I define complexity as the subdivision into organizational components (such as vertical differentiation) that necessitate integration. Complex organizations have more organizational components compared to less complex organizations that require less subdivision (Bowditch & Buono, 2005; Rainey, 2014). I define vertical differentiation as the number of levels in an organization or the division of labor across hierarchical levels (Bowditch & Buono, 2005; Egeberg, 2012; Rainey, 2014). Next, I define integration as the quality of collaboration within an organization to unify efforts, based on the environment (Bowditch & Buono, 2005; Lawrence & Lorsch, 1967). There are two types of integration: indirect and direct. Indirect integration consists of coordination, such as that which occurs through informal norms and networks. Direct integration is coordination, such as that which occurs through formalized roles and networks (Bowditch & Buono, 2005; Lawrence & Lorsch, 1967).

I define centralization as the location of decision-making authority at just a few places in higher levels of the organization (Bowditch & Buono, 2005; Rainey, 2014). I define red tape, which is different from formalization, as burdensome administrative rules and requirements throughout the organization that exert negative effects on the institution's effectiveness (Bozeman & Feeney, 2011; Pandey & Scott, 2002; Rainey, 2014). I define budgetary flexibility as the ability of managers to exert control over their budgets to make necessary changes in allocating resources (Moynihan & Andrews, 2010).

1.7 Organization of the Dissertation

This dissertation is organized into five chapters. After the introduction, Chapter 2 includes an exploration of the theory and literature that frame this research, as well as the

expected outcomes of the questions posed. Based on the literature and theory, the hypotheses proposed are as follows:

H1. Comparing U.S. institutions of higher education (IHEs) reveals that those with greater hierarchy do not perform natural disaster preparedness as well as those with less hierarchy.

H2. Comparing U.S. institutions of higher education reveals that those with the direct integration exhibit better performance in natural disaster preparedness than those with indirect or no integration.

H3. Comparing U.S. institutions of higher education reveals that those institutions that afford emergency managers flexibility over their budget exhibit better performance in natural disaster preparedness than those without budgetary flexibility.

H4. Comparing U.S. institutions of higher education reveals that those institutions with less centralized decision-making exhibit better performance in natural disaster preparedness than those with more centralized decision-making.

H5. Comparing U.S. institutions of higher education reveals that those institutions with less organizational red tape exhibit better performance in natural disaster preparedness than those with more organizational red tape.

Chapter 3 describes the procedures for data exploration and measurement analysis of the operationalization of the concepts. The research design I used was a correlational, sequential, exploratory mixed-methods design. I conducted cross-sectional semistructured interviews to inform the design of a cross-sectional online survey to collect data. Despite the limitations of the study, I have addressed the related concerns by

considering the study's exploratory nature and the difficulty of obtaining such data. I used linear regression for most of the models. Two models use overly dispersed count variables, so negative binomial regression was used to conduct these analyses.

Chapter 4 comprises the results of the quantitative analysis. Each hypothesis was addressed using the four output models and the four outcome models. Linear and negative binomial regression models were evaluated with both visual and statistical diagnostic tests, where applicable. This study presents various evidence that structure and budgetary flexibility does influence natural disaster preparedness performance. However, not all types of outputs or all measurements of outcomes are predicted significantly by structure and budgetary flexibility. Budgetary flexibility is related to some increases in performance. Coordination influences performance more than layers of hierarchy do. This provides an argument for New Public Management (NPM) providing a more effective and efficient way to manage, compared to the traditional approach to public administration.

Finally, Chapter 5 includes discussion and concluding remarks. This study presents an opportunity to test the part of contingency theory that posits organizational structure predicting performance and the managerial aspect of NPM that argues for letting managers manage, which can lead to improved performance. There are important caveats to note. NPM does not consider the political or legal approaches to public administration and is not a complete replacement for hierarchy. A need can exist for different types of structure in an organization operating simultaneously. Further exploration, such as an expanded look at contingency theory, is required to consider the influence of the

environment on structure choice, in addition to mediating and moderating factors that may play a role.

CHAPTER 2: LINKING ORGANIZATIONAL STRUCTURE AND NATURAL DISASTER PREPAREDNESS

Since natural disasters and other threats are increasing, safety on university and college campuses is of concern to the public as well as to faculty, staff, and students. This study examines how organizational structural components and budgetary flexibility affect levels of natural disaster preparedness performance outputs and outcomes in institutions of higher education (IHEs). Institutionalism, organization theory, and approaches of New Public Management (NPM) define the theoretical basis for this study (see Figure 1).

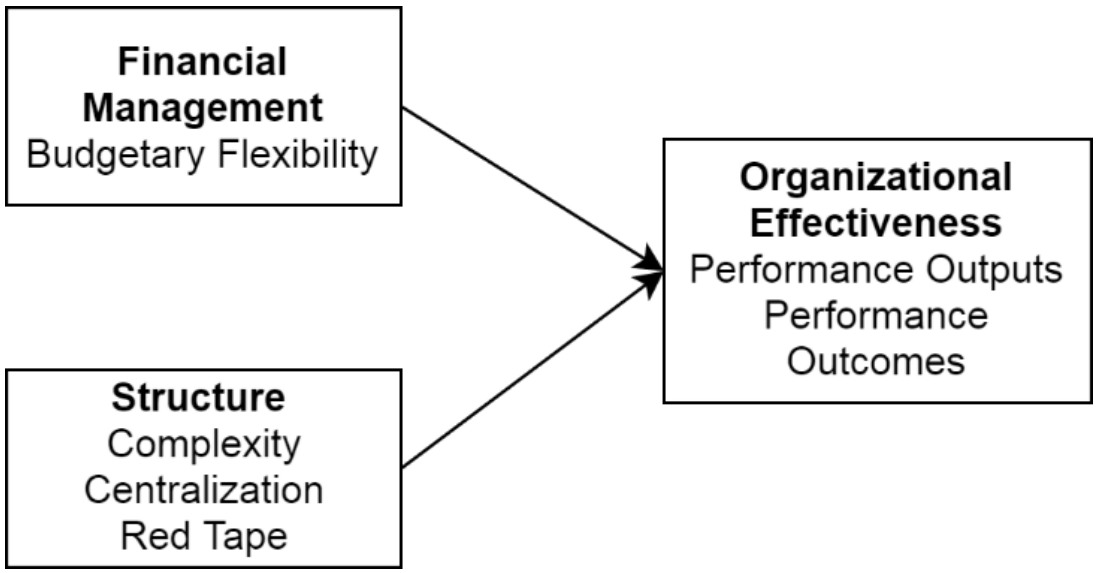

Figure 1. Conceptual Diagram

2.1 Why Study Institutions?

Early scholars studying institutions tend to take a normative approach (Peters, 2011). Selznick (1957) describes an institution as more than a mere set of rules and objectives to be carried out rationally. Rather, an institution is a "responsive, adaptive

organism" (p. 5). Organizational charts provide a framework in which to operate, but added strength can be gained through adaptive human behavior that occurs outside the formal system (Selznick, 1957). Peters (2011) further elaborates on Selznick's (1957) idea of the logic of appropriateness, by which an institution can motivate members through managerial structuring of activities rather than just physical structure. However, this view of institutionalism alone does not address adapting for effectiveness (Donaldson, 2001), so it is necessary to look at March and Olsen's (1983, 2006) perspective.

March and Olsen (1983) advocate for a new institutionalism that includes rational choice. Rational-choice theory assumes that a political system consists of a number of individual actors and that collective behavior is best understood by examining the interconnecting behaviors at lower levels of aggregation (March & Olsen, 1983, 2006). The assumption that this behavioral element exists is known as individual maximization. However, institutions are designed to shape individual behavior through norms rather than mechanical structure (March & Olsen, 1983, 2006; Peters, 2011). New institutionalism and rational-choice approaches fit with contingency theory, in that formations purposefully move the institution toward a goal or organizational effectiveness (Donaldson, 2001; Peters, 2011, 2016).

2.2 How Are Universities and Colleges Institutions?

Peters (2011) describes the important elements of an institution. The essential elements are understanding an institution as a structural feature that displays stability over time, affects individual behavior, and whose members have shared values. Most

studies involve primary and secondary educational institutions, leaving higher education without much sustained examination (Scott, 2015).

Public organizations transform gradually by adapting to internal and external pressures that can lead to institutionalization. Institutionalization occurs as organizations develop their culture through their informal norms and values (Lægreid & Verhoest, 2010; Selznick 1957). Institutionalization includes infusing formal organizations with values beyond the technical requirements of the task at hand (Ansell, Levi-Faur, & Trondal, 2017; Selznick 1957). Kraatz and Zajac (2001) use institutions of higher education to assess Selznick's perspective that integrated institutions adapt well to threatening environments. Gustafson and Reger (1995) and Ansell, Boin, and Farjoun, (2015) find that strong organizational identities and well-integrated institutions may help organizations adapt to environmental crises.

Trani and Holsworth (2010) mention Bok's (1982) description of the original role of universities as "places where scholars can pursue truth in a disinterested way" (p. 5). However, along with Trani and Holsworth (2010), Bok (1982) also proposes that university and college roles are transforming into indispensable actors in the social and economic development of society, not merely educating those within the institution. The number of relationships between colleges and universities and the community, including nonprofits and government agencies, is increasing drastically. Not only large state schools but also community colleges and private schools are forging better relationships with their communities. Moreover, partnerships are extending beyond contracts. Communities and IHEs are partnering to blend academic and practical expertise to address important social issues (Trani & Holsworth, 2010).

2.3 Organizational Theory

Gulick (1937) proposes that organization theory concerns the structure of coordination for establishing and perfecting the structure of authority between leader and subdivisions. Gulick's (1937) managerial perspective values efficiency, economy, and effectiveness. These foci should guide the structure and process of public administrative organizations. The division of labor in an organization is important; however, coordination of effort becomes essential. Gulick (1937) describes the two forms of coordination by organization (i.e., the structure of authority and standing orders) and by idea, working together to address one matter using different skills.

Weber first introduced the idea of an ideal-type model of bureaucracy to describe organizations as rational systems (Scott & Davis, 2006). Weber defined bureaucracy as including a set of organizational elements to control and coordinate activities so that administrative responsibilities are executed in a rational and deliberate way. The structural elements included in Weber's theory address fixed official duties, the hierarchy of authority, systems of rules, technical expertise, career service, and written documentation. Weber believed that a well-developed bureaucracy is the most efficient form of administration (Tompkins, 2005).

While there are critics of bureaucracy, it is a dominant organization design for public entities. Institutions today still use many of the key characteristics of bureaucracy. The characteristics stated in Weber's bureaucratic theory affect institutional behavior in predictable ways. Stating it clearly, the design of an organization affects its behavior and the behavior of the members (Rosenbloom, Kravchuck, & Clerkin, 2009). The theory of

bureaucracy sets the stage to move into the open rational-system model of organizational design and structure.

According to Scott's layered model of organizational perspectives, organizations are studied as closed versus open systems and rational versus natural systems. The rational perspective proposes that organizations are cooperatives concerned with comparatively specific goals and exhibiting more formalized structures. The natural perspective suggests that organizations are collectives whose members are practicing multiple interests but recognize the benefit of sustaining the entity as a valuable resource. A closed system perspective views an organization as separate from its environment, with the same participants. According to Scott and Davis (2006), the open system perspective states that "organizations are congeries of interdependent flows and activities linking shifting coalitions of participants embedded in wider material-resource and institutional environments" (p, 32). These perspectives move through theory development in linear time (see Figure 2).

Organizational theories are based not only on system type but also on levels of analysis. Theories are divided into three basic levels: social psychological, organizational, and ecological (Scott & Davis, 2006). This research study focuses on the organizational level of analysis, using the open-rational-model perspective. The organizational level of analysis examines the structural features of organizations. These can include but are not limited to communication networks and hierarchy. The open-rational perspective on organizations combines the ideas of goal setting with adapting to the organizational environment (Lawrence & Lorsch, 1967; Scott & Davis, 2006).

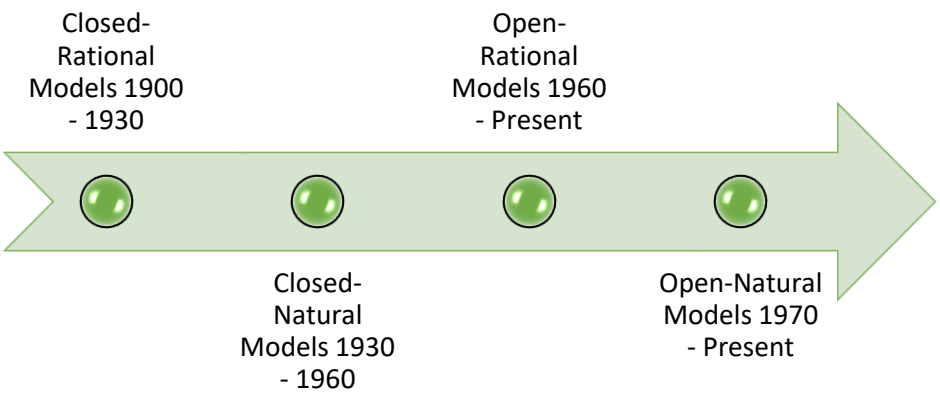

Figure 2. Timeline of Organizational Theory Development. Adapted from Scott's Layered Model in Scott & Davis (2006, p. 112).

Contingency theory, which uses the open-rational-model perspective, suggests that organizational design and structure depend on environmental conditions in which the organization is situated. Thus, those organizations that adapt their internal structures to meet the demands of their external environments will achieve the best organizational structure to perform effectively (Donaldson, 2001; Hult, 2012; Lawrence & Lorsch, 1967; Scott & Davis, 2006; Stazyck & Goerdel, 2011). Natural disasters are an external product of an IHE's environment. Institutions that successfully adapt their internal organization to external threats will be more effective at performing emergency preparedness tasks.

In addition to the general concept of contingency theory of organizations as rational-open systems that can shape their internal structure to deal with their environment, Thompson (1967) introduces the levels model. The idea presented with the levels model is that all three perspectives—rational, natural, and open—are present in all organizations. The technical level that transforms inputs into outputs regarding the central mission of the organization is thought to represent the rational perspective. The

managerial level, responsible for designing the systems and handling inputs and outputs, is thought to represent the natural perspective. Finally, the institutional level, responsible for the organization's relationship with its environment, is thought to represent the open perspective (Scott & Davis, 2006; Thompson 1967). Using Thompson's (1967) idea that the open adaptation happens at the higher institutional level, it stands to reason that when dealing with external factors, such as natural disasters, the unit responsible for preparedness would more likely be situated at the higher institutional level than at a lower technical level. If not at a higher level, then the unit responsible for natural disaster preparedness should have the flexibility to take on a more collegial pattern to increase effectiveness as situational complexity increases (La Porte, 1996).

2.4 Organizational Structure and Performance

There are two aspects of organizational structure. The first addresses physical aspects (e.g., size), and the second includes strategic decisions that the managers will make to influence the behavior of the organization's members to achieve organizational effectiveness (Dalton, Todor, Spendolini, Fielding, & Porter, 1980; Walker, Boyne, & Brewer, 2010). Organizing structures have two basic functions, namely, to control behavior within the organization and enable decisions to be made and actions carried out (Hall, 2001). Organizational structure comprises the dimensions of an organization that describe how it divides tasks, decides who does what and how, and is the connective fiber that controls member behavior (Bowditch & Buono, 2005; Egeberg 2012; Scott, 1981). Organizational structure includes dimensions such as complexity, centralization, and red tape (Bowditch & Buono, 2005; Hage & Aiken, 1967; Rainey, 2014; Walker et al., 2010).

Centralization occurs when the decision-making authority is located in a few places at higher levels of the organization (Bowditch & Buono, 2005; Rainey, 2014). Centralized decision-making is an important indicator of how resources are allocated within an organization (Andrews, 2010) and has been recognized as an essential area of research (Pugh, Hickson, Hinings, & Turner, 1968). The degree of centralization is an important determinant in decision-making and advantageous to organizational effectiveness (Gulick & Urwick, 1937; Weber 1947).

Centralization has been associated with many dysfunctional aspects of public organizations, such as rigidity and red tape (Downs, 1967; Niskanen, 1971; Tullock, 1965). Centralization also limits managers from making decisions and responsiveness to the environment that would improve performance (Andrews, 2010). Some empirical evidence shows that centralization leads to decreased organizational effectiveness (Anderson, 1995; Moynihan & Pandey, 2005).

Red tape, which differs from formalization, is burdensome administrative rules and requirements throughout the organization that have negative effects on the institution's effectiveness (Bozeman & Feeney, 2011; Pandey & Scott, 2002; Rainey, 2014). According to Bozeman (2000), there are two kinds of red tape—organizational and stakeholder. In this study, I examine organizational red tape. Stakeholder red tape assesses the level of red tape from different perspectives within and outside of an organization (Bozeman, 2000; Bozeman & Feeney, 2011). For this study, I am interested in the organizational red tape involved with natural disaster preparedness of the university or college, from the perspective of the emergency manager.

There many presumptions regarding red tape and its negative effects. However, only a few studies use red tape at the organizational level and examine its effect on organizational performance (Andrews, 2010). Those studies find that red tape is inversely related to organizational performance (Brewer & Walker, 2010; Walker & Brewer, 2009). Moreover, Pandey and Moynihan (2006) find that the migration effects of other organizational characteristics reduce the negative effects of red tape on organizational effectiveness. Considering these findings, Boyne, Meier, O'Toole, and Walker (2006) suggest that research related to other organizational characteristics could lead to additional moderating variables for red tape.

Complexity is the division of organizational components (e.g., vertical differentiation) that give rise to the need for integration of coordination. The more division into components the more complex the organization is (Bowditch & Buono, 2005; Rainey, 2014). Vertical differentiation is the number of levels in an organization or division of labor across hierarchical levels (Bowditch & Buono, 2005; Egeberg, 2012; Rainey, 2014). Also, integration is the quality of collaboration within an organization, aiming to unify efforts driven by the environment (Bowditch & Buono, 2005; Lawrence & Lorsch, 1967). When present, the two types of integration are indirect and direct. Indirect integration consists of indirect coordination, such as informal norms and networks. Direct integration is direct coordination, such as formalized roles and networks (Bowditch & Buono, 2005; Lawrence & Lorsch, 1967).

According to Andrews (2010), some scholars argue that vertical differentiation is harmful to organizational performance. Empirical evidence testing complexity and

effectiveness is scarce (Andrews, 2010); however, Anderson (1995) found that the success of pharmacies was related to lower levels of complexity.

2.5 Public Management

According to traditional public administration (TPA), the government was a "lumbering" bureaucracy that operated differently from private-sector businesses (Osborne & Gaebler, 1993). TPA also held values of strict hierarchy and rules for managers to follow. Managers were afforded little to no discretion. While TPA valued efficiency, effectiveness was not assessed because the focus was on processes and inputs (Bryson, Crosby, & Bloomberg, 2014; Christensen & Lægreid, 2011; Hood, 1991, 2000).

New Public Management (NPM) is a departure from TPA. NPM offers the idea that at least where management is concerned, public- and private-sector management do not really differ, and management techniques and concepts used in private business can be used in public management (Bryson, Crosby, & Bloomberg, 2014; Christensen & Lægreid, 2011; Hood, 1991, 2000). Once that is established, a doctrine of NPM includes a shift from accountability using process and inputs, to accountability mechanisms that emphasize results measured by outputs and outcomes. And, to improve efficiency and effectiveness, NPM emphasizes management skills rather than rules and devolution of responsibilities, decision-making, and control (Bryson, Crosby, & Bloomberg, 2014; Christensen & Lægreid, 2011; Hood, 1991, 2000). Osborne and Gaebler (1993) offer recommendations to address the problems with TPA. One key recommendation is to replace the hierarchy with participatory structures that include decentralizing to encourage participation, flexibility, and productivity.

Managerialism defines the idea of "management" as a particular set of skills that functions the same, whether managing in a private or public organization (Christensen & Lægreid, 2011; Painter, 1988; Pollitt, 1998). Christensen & Lægreid (2011) also present the concept that managers expected to show results should have significant discretion along with devolution of resources. Moreover, managerialism places importance on defining and measuring performance outputs and outcomes to assess effectiveness (Christensen & Lægreid, 2011).

Hood and Jackson (1991) propose several administrative doctrines that match NPM assertions. Many of these doctrines come from managerialism (Christensen & Lægreid, 2011). The intersection of the doctrines and the concepts that this study examines includes two important points. Christensen & Lægreid (2011) posit first "a preference for managerial discretion over tight managerial constraints" and, second, "a preference for focusing on results (outputs and/or outcomes) over focusing on good processes (or inputs)" (p. 23).

2.6 Financial Management and Budgetary Flexibility

Kioko et al. (2011) say that financial resources drive outcomes that matter to public administration. Moynihan and Andrews (2010) even go as far as to say it is the "lifeblood of public service provision" (p. 60). A global trend of reforms is seeking higher quality outcomes for less (Kioko et al., 2011; OECD, 1995; Peters, 1996; U.S. General Accounting Office, 1995). Moreover, limited amounts of financial resources and competition for them require making financial decisions. It makes sense that public financial management (PFM) would play a role in organizational performance (Moynihan & Andrews, 2010), to solve age-old public-administration puzzles such as these two

posed by Kioko et al. (2011): “How do we manage public organizations to achieve the best outcomes?” (p. 114), and “How do public organizations adapt to their changing environments?” (p. 114).

Little research has been done connecting PFM to public organizational performance (Kioko et al., 2011; Moynihan & Andrews, 2010). According to Finkler, Smith, Calabrese, and Purtell (2016), PFM is a subset of management that promotes using financial information so that managers can make better decisions that affect an organization’s capacity to achieve desired goals. Included in the PFM system are budgeting and resource management. It is important to have budgetary flexibility in order to be able to exercise PFM, especially in resource management or the ability to allocate funds (Moynihan & Andrews, 2010). Budgetary flexibility includes having the authority to allocate funds (Lu & Willoughby, 2015; Moynihan & Andrews, 2010). Furthermore, Moynihan and Andrews propose that managers need greater budgetary flexibility in order to make changes necessary to achieve the desired level of performance (Moynihan & Andrews, 2010).

2.7 New Public Management in Institutions of Higher Education (IHEs)

Global public-sector reforms have been implemented to improve the performance of public organizations (Broucker & Wit, 2015; Pollitt & Bouckaert, 2000). Institutions of higher education have implemented these reforms also, to meet the same objectives (Broucker & Wit, 2015; Dobbins, Knill & Vögtle, 2011). Universities once regarded as communities of scholars, researching and teaching together in collegial ways, now find themselves in a “make the managers manage” situation with academic leaders rather than managers who must justify expenditures and demonstrate effectiveness (Deem, 1998).

As a part of IHE reform, managers are given more autonomy, discretion, and budgetary flexibility in managing resource allocation (Enders, de Boer, & Weyer, 2013). Enders et al. (2013) found that a University's managerial decision-making capabilities are related to primary-mission outputs. Additionally, the authors found that universities with managerial discretion that look to effectiveness in organizational support functions have more outputs.

2.8 Emergency Preparedness

According to Mileti (1999), the theoretical basis for emergency management in preparedness includes the rational-choice theory. Individuals, governments, and other organizations choose how to cope with or adjust to natural disasters, based on the information available. In addition, emergency preparedness is conducted within the bounded-rationality model of decision-making, which can apply to individuals or organizations such as IHEs. As decision-making organizations, universities make choices based on limited knowledge and within constraints set by the system (Mileti, 1999).

Preparedness is one of the four stages of emergency management. The other stages include mitigation, response, and recovery. These stages are not mutually exclusive, and they overlap (Kusumasari, Alam, & Siddiqui, 2010). Kusumasari, Alam, and Siddiqui (2010) introduce several key functional success factors in local government capability requirements for disaster management. They include institutional factors, human resources, policy for effective implementation, financial and technical factors, and leadership. It is important to have clarity in design, roles, responsibilities, and relationships between all levels of government, as well as sufficient personnel, proper assignment delegation, and division of labor. The availability of appropriate policies,

rules, and regulations for decision-making, mobilizing resources and utilizing organizations is central to emergency management. In addition, having sufficient financial resources to support activities in all stages of disaster management is crucial, as are effective logistical management systems, sufficient technology information systems, and communication networks among organizations, communities, and media representatives for disaster management. Moreover, building local-level leadership to make quick and appropriate decisions during disasters is critical (Kusumasari, Alam, & Siddiqui, 2010).

Kusumasari, Alam, and Siddiqui (2010) list critical management-capability requirements for disaster preparedness. The capability requirements include planning both on-site and off-site, exercises, training, and logistical-management expertise. The process of the preparedness stage includes increasing awareness of potential disaster risk and vulnerability among communities, through effective communication channels. The potential actors in the preparedness stage include consultants, implementing agencies, governments, subcontractors, and suppliers (Kusumasari, Alam, & Siddiqui, 2010).

Gillespie and Streeter (1987) maintain that disaster preparedness includes planning, resources, warning systems, training, and any predisaster action that improves the safety and effectiveness of disaster response. Organizational characteristics and interorganizational relations have relationships with preparedness. Organizational characteristics include experience, subculture, capacity, and formalization. Research has shown a positive association between previous experiences with disasters and preparedness (Anderson, 1969; Britton, 1981). In addition, this line of research indicates that organizations that develop a disaster subculture are more likely to be prepared than

organizations that have none (Moore, 1956). Moreover, Mileti, Drabek, and Haas (1975) show that organizational capacity is positively associated with preparedness. Organizations with more formalization have proved to be better prepared (Drabek, 1985; Raker & Friedsam, 1960). Intraorganizational relations include formalization and exchanges. Studies point out the positive association between interorganizational formalization and preparedness (Mileti, Drabek, and Haas, 1975; Quarantelli, 1985; Wolensky, 1977). Organizations with more organizational exchanges and communication also are more likely to be better prepared (Anderson, 1969; Mileti et al., 1975).

Gillespie and Streeter (1987) operationalized and measured disaster preparedness in their research study, using seven items to operationalize preparedness—four items related to training, two to planning, and one to integrated emergency management. The training questions asked about the number of times the respondent had participated in past disaster training sessions or simulated disaster exercises, and the number of times that future participation in disaster training sessions or simulated disaster exercises was planned. The fifth item asked whether the organization had an emergency plan; the sixth included the number of years and months since the plan had been updated; the seventh asked whether the respondent was familiar with the integrated emergency management concept. The authors find a summative measure of preparedness both reliable and valid (Gillespie & Streeter, 1987).

Kirschenbaum's (2002) research revolves around four dimensional household preparedness categories: provisions, planning, knowledge and skill, and protective items. "Provisions" addresses the need for staffing an Emergency Operations Center (EOC) and assigning responsibility for the role of managing disaster preparedness. "Planning"

includes formal written documents outlining the actions and responsibilities to be taken in the event of a disaster, encompassing the Emergency Operations Plan and Continuity of Operations Plans. The category of "knowledge and skill" refers to training, exercise plans, and updating plans based on results. Finally, "protective items" includes physical objects used in preparedness, such as emergency preparedness manuals located throughout campus and emergency alert notification systems.

Kapucu (2008) presents several factors that affect local public officials' willingness to implement coordination strategies for emergency preparedness. The factors include jurisdictional signs, experience with disasters, organizational design, previously developed relationships, and disaster exercises. His work suggests several coordination strategies used by local governments to prepare for a disaster, including emergency communication procedures, coordination meetings, public information, notification plan, information technology, emergency plan, and disaster exercises. Through proper planning and coordination, organizations and agencies can carry out emergency responses and recoveries more efficiently and effectively (Kapucu, 2008).

2.9 Organizational Strategies for Preparedness

According to Waugh (1993), entities that prepare for activities that include a variety of disaster situations for all phases of emergency management organize differently than those agencies tasked with directing the disaster response alone. Entities with stable task environments tend to organize as Weberian bureaucracies. Traits of this type of organization include a clear hierarchy of command, formal communications, a division of labor, task specialization, etc. Communication is usually top-down in Weberian bureaucracies (Waugh, 1993). On the other hand, organizations involved in

less concrete tasks form more structurally fluid designs than organizations tasked with daily response duties. Organizations designed this way tend to have less interest in hierarchy and formal communications (Waugh, 1993).

Emergency planning tends to form a clear hierarchical design with formal lines of communications, given that the tendency is to think of dealing with routine incidents. However, a great amount of uncertainty is inherent in disaster planning and response. At times, urgent conditions exist, during which organizations must be able to adapt and balance formal hierarchical design and communication with the need to enable coordination and complex problem-solving for dealing with uncertainty (Kettl, 2003; Waugh, 1993; Waugh & Streib, 2006). Kettl (2003) describes this contingent coordination as a collaborative network that includes different organizational levels developed specifically to address such critical problems as natural disasters.

The literature considers bureaucracies inflexible and inappropriate for managing disasters and other crises. Because of their hierarchical decision-making design, inflexible bureaucracies tend to respond slowly to disasters and other critical events. Flexibility improves the swiftness with which an organization responds. A coordinated response requires the collaboration of forces from different functional areas, not hierarchical control. During a crisis, management can be reorganized as a complex system that adapts to the best fit for the demands of an ever-changing environment (Bier, 2006; Bryson, Crosby, & Stone, 2006; Carroll, 2004; Comfort, 2007; Goldsmith & Eggers, 2004).

The disasters of recent years have shown deficiencies in current emergency management designs worldwide. One such occurrence was Hurricane Katrina. In her

analysis of the bureaucratic problems during the response and recovery, Bier (2006) suggests that several of the issues were related to coordination. Research has shown that organizations structured with inflexible boundaries, top-down approaches, and command-and-control mechanisms are less effective than other organizations that are flexible and can adapt (Bier, 2006; Druckman, Singer, & Van Cott, 1997; Kapucu & Garayev, 2016; Krackhardt & Stern, 1988; Provan & Lamaire, 2012). Attention should be given to establishing relationships and cultivating their development across organizational subunits. The reason problems that are unknown or inconsistent typically necessitate a network response is not only the need to be highly adaptive but also because the resources, knowledge, and solutions are spread across many different entities. When disaster events occur, networks are more effective than a hierarchy. Organizations that must deal with uncertainties should cultivate networking outside of immediate work units (Bier, 2006; Druckman et al., 1997; Kapucu & Garayev, 2016; Krackhardt & Stern, 1988; Provan & Lamaire, 2012).

The literature regarding organizational strategy largely presents designs based on the approach of providing for disaster preparedness through clearly defined authority, constant provision of disaster services, and assessment of the delivery system (Banerjee & Gillespie, 1994). An organization that assigns the responsibility for disaster preparedness presents a clearly defined line of authority. In addition, prioritizing disaster preparedness and evaluation of management systems cultivates a higher level of preparedness performance. Disaster preparedness is more successful if it is part of the strategic plan for leadership than if leadership ignores preparedness. Organizations that espouse values, norms, attitudes, and stories that support a climate of disaster

preparedness are more likely to be prepared for disasters (Anderson, 1969; Gillespie & Streeter, 1987).

Placement of the responsibility for disaster preparedness in the organization can reflect the values and attitudes of the organization's leadership toward the issue. Leadership support is necessary to develop and implement a disaster-preparedness program; it can also help with buy-in for the preparedness plans and build internal and external partnerships that add to the process (Kapucu & Khosa, 2013; Velazquez, Munguia, & Sanchez, 2005).

2.10 Hypotheses

Based on the theory and literature detailed in this chapter, I propose the following hypotheses:

H1. Comparing U.S. institutions of higher education (IHEs) reveals that those with greater hierarchy do not perform natural disaster preparedness as well as those with less hierarchy.

H2. Comparing U.S. institutions of higher education reveals that those with the direct integration exhibit better performance in natural disaster preparedness than those with indirect or no integration.

H3. Comparing U.S. institutions of higher education reveals that those institutions that afford emergency managers flexibility over their budget exhibit better performance in natural disaster preparedness than those without budgetary flexibility.

H4. Comparing U.S. institutions of higher education reveals that those institutions with less centralized decision-making exhibit better performance in natural disaster preparedness than those with more centralized decision-making.

H5. Comparing U.S. institutions of higher education reveals that those institutions with less organizational red tape exhibit better performance in natural disaster preparedness than those with more organizational red tape.

2.11 Summary

This chapter introduces the theoretical framework and previous results from the literature. I use institutionalism, organizational theory, and managerialism as a doctrine of NPM to guide the proposed hypotheses. The literature establishes links from practice in actual events and previous research results that corroborate the hypotheses within the theoretical framework. Chapter 3 will discuss this study's research design.

CHAPTER 3: METHODOLOGY

This study uses institutionalism, organization theory, and NPM to examine how organizational structure affects performance in natural disaster preparedness at universities and colleges. I have applied a mixed-methods approach to address the following questions:

Q1. How does the degree of natural disaster preparedness of an institution of higher education vary with organizational structural complexity?

Q2. How does natural disaster preparedness performance in institutions of higher education vary with the centralization of decision-making, red tape, and budgetary flexibility?

To provide clarification of terms relevant to my research, I have defined important concepts as follows.

I define emergency preparedness as: "all those activities and measures designed or undertaken to prepare for or minimize the effects of a hazard upon the civilian population, to deal with the immediate emergency conditions which would be created by the hazard, and to effectuate emergency repairs to, or the emergency restoration of, vital utilities and facilities destroyed or damaged by the hazard" (FEMA, 2013, p. 59).

I define a natural disaster as "any hurricane, tornado, storm, flood, high water, wind-driven water, tidal wave, tsunami, earthquake, volcanic eruption, landslide, mudslide, snowstorm, drought, fire, or other catastrophe in any part of the United States

which causes, or which may cause, substantial damage or injury to civilian property or persons" (FEMA, 2013, p. 59).

I define organizational structure as the dimensions of an organization that dictate how tasks are divided, determine who does what and how, and serve as the connective fiber that controls members' behavior (Scott, 1981; Bowditch & Buono, 2005; Egeberg 2012). The dimensions of organizational structure include complexity, centralization, and red tape.

I define complexity as the subdivision into organizational components (such as vertical differentiation) that necessitates integration (Bowditch & Buono, 2005; Rainey, 2014). I define vertical differentiation as the number of levels in an organization or the division of labor across hierarchical levels (Egeberg, 2012; Bowditch & Buono, 2005; Rainey, 2014). Next, I define integration as the quality of collaboration within an organization to unify efforts based on the environment (Bowditch & Buono, 2005; Lawrence & Lorsch, 1967). There are two types of integration: indirect and direct. Indirect integration consists of coordination, such as that which occurs through informal norms and networks. Direct integration is coordination, such as which occurs through formalized roles and networks (Bowditch & Buono, 2005; Lawrence & Lorsch, 1967).

I define centralization as the location of decision-making authority at just a few places in higher levels in the organization (Bowditch & Buono, 2005; Rainey, 2014). I define red tape, which differs from formalization, as burdensome administrative rules and requirements throughout the organization that negatively influences the institution's effectiveness (Rainey, 2014; Bozeman & Feeney, 2011; Pandey & Scott, 2002). I define

budgetary flexibility as the ability of managers to exert control over their budgets to make necessary changes in allocating resources (Moynihan & Andrews, 2010).

Based on the theory and literature previously discussed, I propose the following hypotheses:

H1. Comparing U.S. institutions of higher education reveals that those with greater hierarchy do not perform natural disaster preparedness as well as those with less hierarchy.

H2. Comparing U.S. institutions of higher education reveals that those with the direct integration exhibit better performance in natural disaster preparedness than those with indirect or no integration.

H3. Comparing U.S. institutions of higher education reveals that those institutions that afford emergency managers flexibility over their budget exhibit better performance in natural disaster preparedness than those without budgetary flexibility.

H4. Comparing U.S. institutions of higher education reveals that those institutions with less centralized decision-making exhibit better performance in natural disaster preparedness than those with more centralized decision-making.

H5. Comparing U.S. institutions of higher education reveals that those institutions with less organizational red tape exhibit better performance in natural disaster preparedness than those with more organizational red tape.

To test the above hypotheses, I have utilized linear regression for six models. The following equations represent the models used:

E1. Output (exercise, planning, internal, external) = β_1Central Decision + β_2Red Tape + β_3Budget Flexibility + β_4Hierarchy + β_5Coordination + Controls + Intercept

E2. Outcome (impact, effectiveness) = β_1Central Decision + β_2Red Tape + β_3Budget Flexibility + β_4Hierarchy + β_5Coordination + Controls + Intercept

Additionally, two models used count variables for the regressands. For these models, I used negative binomial regression with the exposure variable of natural hazard risk. Natural hazard risk is a control variable in the other models. The models employed to test the above hypotheses are displayed below:

E3. Number of Days (canceled, delayed) = exp (β_1Central Decision + β_2Red Tape + β_3Budget Flexibility + β_4Hierarchy + β_5Coordination + ln(Natural Hazard Risk) + Controls + Intercept)

3.1 Research Design

The research design used in this dissertation is a correlational, sequential, exploratory mixed-methods design involving cross-sectional semistructured interviews to inform the design of a cross-sectional online survey. The Institutional Review Board (IRB) approved this study as exempt on March 31, 2017, and provided final modification and indefinite approval on May 18, 2018 (see Appendix A). The IRB application applies to both the qualitative and quantitative data collection.

3.1.1 Mixed Methods

Creswell (2015) and Johnson, Onwuegbuzie, and Turner (2007) describe mixed-methods research as an approach to research that combines both quantitative and qualitative techniques to provide a more in-depth understanding of the research questions. Mixed methods are appropriate when quantitative or qualitative research alone is

insufficient to fully understand the problem (Creswell, 2015). More specifically, mixed-methods designs can provide assurance that instruments and measures fit the participants through the exploration of qualitative data (Creswell, 2015; Rossman & Wilson, 1985).

Creswell (2015) describes three basic designs of mixed-methods studies: convergent design, explanatory sequential design, and exploratory sequential design. A convergent design entails collecting and analyzing quantitative and qualitative data, then merging the results. An explanatory sequential design begins with quantitative research and subsequently integrates qualitative data to explain the results of the quantitative data analysis. An exploratory sequential design employs qualitative data to inform the development of a survey that involves collecting quantitative data.

A mixed-methods sequential exploratory design consists of three distinct phases: qualitative techniques, instrument development, and quantitative data collection (Creswell, Fetters, & Ivankova, 2004). In this design, the researcher first collects qualitative data and analyzes it; then, uses the information obtained from the qualitative analysis to design an instrument. Once completed, an investigator uses the developed tool to gather quantitative data. According to Creswell (2015), an exploratory sequential design allows researchers to investigate a problem that is not well-defined or an under-researched population. In addition, the lack of current concept operationalization is another benefit of an exploratory component in a mixed-methods study (Creswell & Clark, 2018; Johnson et al., 2007). Additionally, this basic design is used to generate informative data. In this context, the mixed-methods approach can be particularly useful. This technique aids in developing better wording for questions and enhanced

measurement capability of scales to use in the quantitative collection tool (Bryman, 2006; Greene, Caracelli, & Graham, 1989; Madey, 1982; Sieber, 1973).

3.1.2 Exploratory Sequential Design Specifics

Using an adapted design diagram by Morse (1991), Figure 3 illustrates the exploratory sequential design used for this study. To explore in depth the natural disaster preparedness of postsecondary schools and develop a measure that encompasses its dimensions, I selected an exploratory sequential design to employ in my research. In the first step, I gathered qualitative data from semistructured interviews and produced transcripts to analyze, seeking information relevant to developing a survey instrument.

In the second step of the survey-instrument development process, measures were designed to conceptualize natural disaster preparedness. Experts in emergency management and survey design reviewed and pretested[1] the survey instrument. The feedback was incorporated into the survey design prior to distribution. The final step entailed fielding an online survey to collect quantitative data that I used to analyze and interpret results, to address the questions posed by this study in discussions and presentations.

[1] The pretesting process included expert reviews of the survey. I obtained feedback on the draft questionnaire from academic experts with knowledge about survey and research design, content experts with knowledge about emergency management, and members of the target population. Expert reviewers were asked to review and/or complete the survey and provide feedback about the survey.

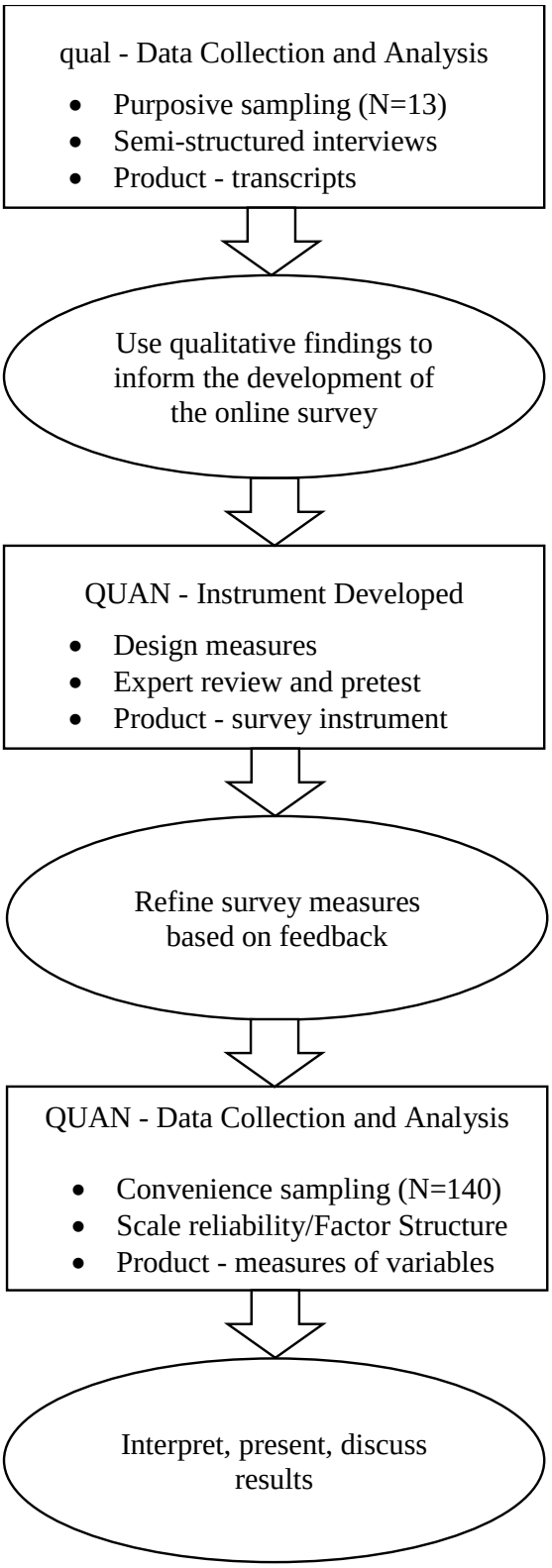

Figure 3. An exploratory sequential design of a mixed-methods study of natural disaster preparedness in higher education institutions

3.2 Qualitative Method

I conducted semistructured interviews with persons charged with overseeing natural disaster preparedness at their institution of higher education (IHE). The qualitative data collection occurred among 14 people across 13 universities and colleges over six months. I designed the survey using information from semistructured interviews, the literature, and theory to assess important organizational and preparedness concepts. The design consisted of interviews to generate informative data, rather than data for causal inference.

3.2.1 Participants

Universities and colleges in the United States constitute the population and unit of analysis of this study. Interviews involved representatives of universities and colleges responsible for natural disaster preparedness. The study has excluded universities and colleges that are for-profit, the service academies, or located outside of the contiguous United States. Exactly 3,274 postsecondary schools satisfied these criteria at the time, according to The Carnegie Classification of Institutions of Higher Education.

This phase of research used purposive sampling to recruit representatives from 13 higher education institutions who held responsibilities for natural disaster preparedness. The sample of interviewee organizations encompassed selected institutions based on the following characteristics: enrollment, urban or rural, region of U.S., nonprofit or public school, residential status, natural hazard risk score, and the number of county presidential disaster declarations from 1953 to 2017. Qualitative research frequently uses purposive sampling techniques to deliberately select participants who can provide essential information that another sampling method might not yield (Maxwell, 1997; Teddlie &

Yu, 2007). The reason for purposive sampling techniques applied in this study involves the goal of sampling to uncover instances that are representative (based on dimensions of interest) of the entire population, using a small number of cases (Teddlie & Yu, 2007). Random sampling is not invariably the optimal choice as a method of selection. In a small sample, random selection may not solve selection bias and may exacerbate it. It is generally better to intentionally identify observations (King, Keohane, & Verba, 1994).

The primary objectives of the qualitative part of this study were to conduct the interviews across the control variables, to establish variation among answers to potential questions, to establish an understanding of how best to word questions, and to gather information, based on open-ended questions, to fill in any gaps related to potential inquiries from the practitioner's perspective. According to King et al. (1994), the best intentional-selection design ensures variation in the control variables without regard to the dependent variable. The sample was based on characteristics and location to accumulate observations that differed across the control variables. This step was vital to understanding what people know about natural disaster preparedness at a university or college. It also indicated who was overseeing the preparedness function at various institutions.

The postsecondary school demographic characteristics used to select institutions encompassed various items, including geographic location and the natural hazard risk score for the county where the university or college is located (see Table 1 for all of the characteristics of each institution). Semistructured interviews included at least one postsecondary school from each of the Bureau of Economic Analysis (BEA) geographic regions in the contiguous U.S. When focusing on structured comparisons employing a

small number of observations for descriptive inference, a systematic, controlled comparison requires the collection of data concerning the control variables (King et al., 1994; George, & McKeown, 1985). By selecting a sample based on observed data, such as the particular variables in Table 1, the small number of observations can better represent the entire population (King et al., 1994).

The research interview-participant recruitment process involved emails as the initial contact, with follow-up phone calls in case of no response. Information obtained from university and college websites identified potential representatives responsible for natural disaster preparedness at the institution. Exploration for emergency management, environmental health and safety, and law enforcement offices, where natural disaster preparedness contacts might work, consisted of reviewing university and college websites for contact information. The email invitation is displayed in Appendix B.

Table 1. Institutional Characteristics for Interviews

Institution	Region	Total Enrollment	Natural Hazard Risk Score	PDDs	Four-year	Public or Nonprofit	Residential	Highly Residential	Urban or Rural
1	Southeast	1,422	26.57	8	Yes	Nonprofit	Yes	No	Rural
2	Far West	24,096	6.5	0	Yes	Public	Yes	No	Urban
3	Mideast	9,627	20.68	0	Yes	Nonprofit	Yes	No	Urban
4	Southwest	36,486	28.1	0	Yes	Public	No	No	Urban
5	Mideast	2,209	13.31	0	Yes	Nonprofit	Yes	Yes	Urban
6	Southeast	10,382	12.06	0	Yes	Public	Yes	No	Rural
7	Plains	24,766	29.13	18	Yes	Public	No	No	Urban
8	Plains	27,180	37.51	0	Yes	Public	Yes	No	Urban
9	New England	4,193	8.38	22	No	Public	No	No	Urban
10	Rocky Mountains*	32,432	11.23	21	Yes	Public	Yes	No	Urban
11	Mideast	47,040	4.68	0	Yes	Public	Yes	No	Urban
12	Mideast	48,378	11.79	0	Yes	Public	Yes	No	Urban
13	Great Lakes	45,140	17.22	16	Yes	Public	Yes	No	Urban

*Interviewed two people at the same institution

Saturation, which refers to the point at which the information received is redundant, is the primary determinant in assessing sample size in qualitative methods. The researcher should avoid becoming saturated and amass sufficient data to represent the phenomenon. A useful guideline is that the longer the transcript, the fewer the number of participants. A range of 5 to 30 participants is typically sufficient, based on the length of the information (Josselson & Lieblich, 2003; Rudestam & Newton, 2014). In this study, interviews from 13 institutions represented an adequate sample size for the qualitative-research phase, given the length and the information obtained.

3.2.2 Data-Collection Procedures

Semistructured interviews conducted by telephone with university and college officials continued between January and April of 2018. Beginning on January 1, 2018, email invitations were sent to 16 colleges and universities. A week later, follow-up attempts entailed sending additional emails. Additional efforts involved a third email sent two weeks after and a final follow-up telephone call to elicit an interview. However, the extensive outreach efforts yielded no additional interviews with this group. Employing network contacts, I solicited meetings with university and college officials, using the same email invitation.

After an email invitation had been accepted, the university agent signed an informed-consent form, and we scheduled an interview (see Appendix C). Semistructured interviews using the list of questions in Appendix D lasted 20 to 50 minutes, depending on how much the officials expounded upon their answers to the inquires, as well as whether their responses elicited further questions. At this stage of the research, participation in the interviews did not involve incentives. Two digital devices recorded

telephone conversations. Research protocol required the transfer of the recordings to two encrypted hard drives for transcription and the removal of interviews from the recording devices. I transcribed and proofed all semistructured interviews prior to analysis. IRB protocol requires the future destruction of all transcripts after publishing all articles based on these data.

3.2.3 Analysis of Interviews

Ideally, when compared to the entire dataset of all the institutions, the interview sample would be representative, based on the observed purposive control variables. I began with selected interviews close to a representative sample, based on aligning the postsecondary school characteristics mean of the interview sample with the mean of the entire dataset. However, due to the lack of participation of selected universities and colleges, convenience sampling was employed to schedule interviews. A new list drew on both characteristics and contacts. When compared with the entire dataset of all postsecondary schools, the interview sample reflects an accurate representation of urban as opposed to rural institutions. However, although the sample was not fully representative of schools other than four-year schools, nonprofit schools either highly residential or nonresidential schools, at least one interview fell into each category (see Figure 4).

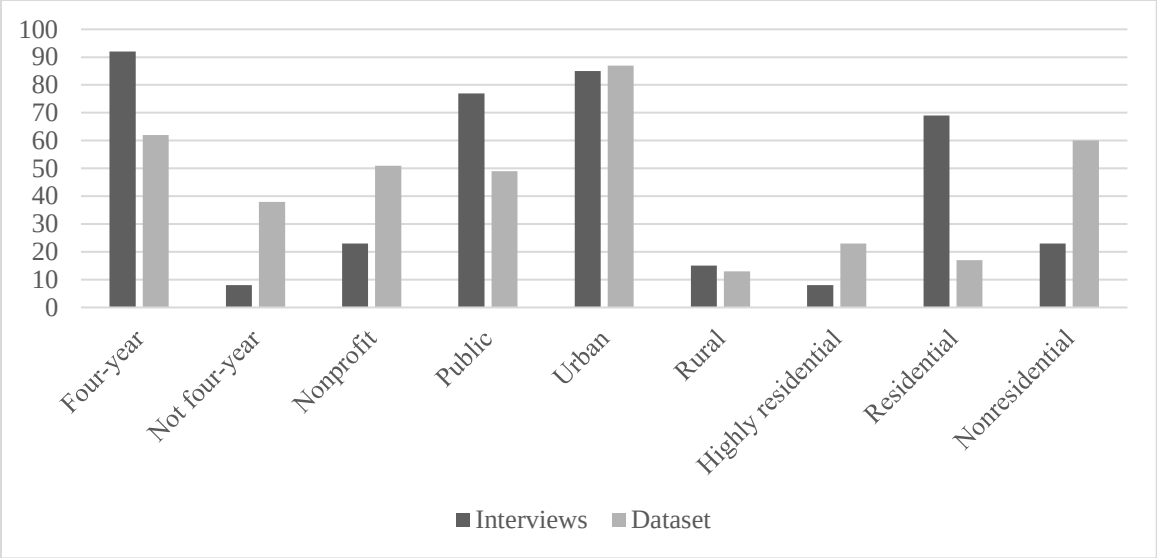

Figure 4. Percentage of Interviewees by Indicators Compared to Entire Dataset

The second objective of the interviews was to determine that variation existed among the institutions regarding the questions asked. Most questions uncovered deviation among the responses. Critical inquiries regarding the research questions and hypotheses displayed differences. There was a broad range of various places to which an emergency manager reports on a daily basis. Reporting lines varied from the police to directors of public safety to vice-chancellors. There was also some deviation in the lines of communication for emergency managers responsible for natural disaster preparedness at their organization. There was also some variation around how formalized the lines of communication are between emergency managers and the policy-making group. Another essential concept identified for change was the hierarchy of the natural disaster preparedness function within the organization. There were differences among the number of layers in the hierarchical structure. There was also variation among answers to the questions concerning whether the hierarchical structure negatively affected natural disaster preparedness at the institution.

Regarding the third objective, the interviews aided in developing and wording questions for the survey. Through the interview process, I identified the need to ask about who has primary responsibility for natural disaster preparedness and whether they share those duties. It also established that the questions regarding the perception of preparedness and threat would need to include sufficient detail to provide a scale for the amount and a specific list of risks. In addition, the interview process demonstrated that smaller universities and colleges might not have a full-time dedicated emergency manager. The person or persons responsible for natural disaster preparedness at the institution may have to devote substantial time to nonpreparedness tasks, such as changing locks. It was fundamental to establish how much time emergency managers dedicated specifically to natural disaster preparedness.

Additionally, while interviewing emergency managers, I discovered that the emergency manager may be responsible for more than one institution, such as in a statewide system. Therefore, it is important to determine the number of institutions for which an emergency manager is responsible, as well as how many campuses that entails. I also found various situations regarding the location of the emergency management function within colleges and universities. This finding prompted the addition of a question about functional changes. It appears that this might be related to the establishment of emergency management programs for universities and colleges during the past decade. These results are necessary for my research because they suggest one potential use of the study related to management. University leadership and emergency managers could utilize these findings to determine the placement of the emergency management function.

3.3 Quantitative Methods

I fielded an online survey that was designed using the results from the semistructured interviews and the literature review. The instrument was distributed to many outlets to ensure that the study had sufficient observations to analyze quantitatively. The overall content consisted of questions directed at assessing university characteristics, such as the annual budget for the unit responsible for natural disaster preparedness, organizational structure, performance outputs, and outcomes. The statistical analyses conducted also used the survey data matched with secondary data.

3.3.1 Participants

The quantitative research phase used the same target population as the qualitative research phase by including representatives responsible for natural disaster preparedness at their university or college. The target population excluded universities and colleges based on the same criteria used in the qualitative sample. As mentioned earlier, at the time, 3,274 universities and colleges met these conditions for inclusion.

I employed a multistage sampling technique for the distribution of the surveys. To recruit representatives from postsecondary schools with responsibility for natural disaster preparedness, I employed a sample frame consisting of a membership list that included names, email addresses, and institutions, from a group specifically for emergency managers in higher education and an attendance list from a conference focused on best practices in IHE emergency management. After processing, the list covered 521 contacts from 391 distinct universities and colleges. I calculated a coverage rate of 12%, using the proportion of the target population that appeared in the frame comprising the membership and attendance lists (Dillman, Smyth, & Christian, 2014).

An important aspect of examining the quality of the sampling frame is accounting for limitations such as coverage errors, ineligibles, clustering, and multiplicity (Weisberg, 2005). According to Weisberg (2005), the coverage error is the magnitude of the mathematical difference between the mean of the sampling frame and the mean of the target population not included in the sampling frame. “Ineligibles” identifies those institutional representatives in the frame who are not part of the target population, such as those associated with for-profit IHEs. Clusters contain organizational representatives who represent an entire system of postsecondary schools. Multiplicity consists of duplicated representatives in the frame (Weisberg, 2005). After assembling the membership and attendance lists, I sought and removed ineligible representatives, representatives of clusters, and duplicated entries for individuals. I retained different representatives from the same organization in the sampling frame to increase the odds of receiving at least one response from an institution.

Two variables of interest—size and risk—represent capacity measured by student enrollment and natural hazard risk measured by a natural hazard risk score. In addition to calculating the coverage-error magnitude, I used Stata 14 to perform an independent sample t-test of the group, to determine whether the means of those universities or colleges in the sample frame differ statistically from those organizations outside of the sample frame (Stone, 2010). For both enrollment and natural disaster risk, the means of the sample frame significantly differ from the means of the institutions not included in the sample frame (see Table 2). The coverage error for enrollment is 7,029 students (88% x (12,704 - 4,717)) and for risk is 7.84 units (88% x (30.72 - 21.81). The enrollment of the colleges and universities not in the sampling frame mean is lower than those in the

frame mean. This coverage error most likely occurred because larger organizations can employ a professional emergency manager who would belong to an organization or attend professional conferences. Moreover, the mean for the hazard risk of the IHEs not in the sampling frame is lower than that of those in the frame. The reason for this might be a decision not to hire personnel with emergency management skills because the risk is not sufficiently high to justify the cost.

There is no way of knowing how many universities and colleges employ a person dedicated to or tasked with responsibility for emergency management, which includes natural disaster preparedness. Based on the interviews and other professional conversations with emergency managers at institutions of higher learning, I learned that it is a new position. Even leading universities have only recently hired full-time managers, such as Wake Forest University, which hired its first full-time emergency manager on January 5, 2015 (Wood-Parker, 2015).

The sample consisted of the entire frame list of email addresses. The response rate for the first sampling phase was 15% (58 completed surveys out of 391 institutions, no two from the same IHE). The 85% consisted of 5% invalid email addresses, 11% who opted out, 67% who did not click through to the survey, and 2% who partially completed it.

Table 2. Results of *t*-test for Enrollment and Natural Disaster Risk by In or Not in Frame

	In or Not in the Sample Frame								
	In			Not In					
	M	SD	n	M	SD	n	t	df	*p*
Enrollment	12704.31	12533.96	391	4717.15	7226.96	2883	-18.42	3272	.00
Natural Disaster Risk	30.72	21.67	391	21.81	17.09	2882	-9.34	3271	.00

With 58 completed surveys representing 15% of the frame and an unknown frame of institutions that assigned the emergency management task, I decided to conduct a second nonprobability sample using listservs and email lists. The main listserv is the Disaster Resilient Universities® (DRU) listserv, established in 2005 and serving over 1,500 members representing over 800 universities and colleges (Le Duc, 2016). However, the DRU membership includes not only colleges in the United States or emergency managers at postsecondary schools, but also schools in other countries and various other people interested in disaster-resilient universities. I also distributed the anonymous link to the FEMA Higher Education Program Newsletter and several state emergency management associations. The FEMA Higher Education Newsletter may reach professors as well as emergency managers. State associations also include emergency managers from state- and local-level positions. Of all the anonymous links distributed, 201 potential representatives began the survey. One representative declined to agree to the electronic consent form, and the study was terminated. Of the remaining 200, 111 (55.5%) finished, and 89 (44.5%) partially completed the survey.

3.3.2 Instrument

The instrument used to collect data consisted of an online survey managed by Qualtrics survey software. The survey tool contained 68 items (see Appendix E). The instrument included an electronic consent form as the first item. The first topic encompassed background information concerning the organization and the respondent's responsibilities. The survey incorporated a section to assess the respondent's knowledge and perception of preparedness. Another section comprised a series of organizational structural questions. Resources available for natural disaster preparedness were indicated

in the next segment of the survey instrument. Two sections each contained a series of questions regarding performance outputs and outcomes of the natural disaster preparedness function, respectively. Other portions collected information regarding the professionalization of the emergency management role at the institution, comments, sensitive and identifying information, and contact information.

3.3.3 Data-Collection Procedures

I used the Qualtrics Survey Software distribution feature to recruit participants for the survey sample frame, with follow-ups sent automatically. I disseminated emails through the distribution feature to potential representatives on June 4, June 12, June 25, and July 19, 2018. The links in the emails to individuals in the sample frame were unique to the potential respondents. Respondents could begin and finish the survey later from any device by using their hyperlink. A sample email invitation to the online instrument is displayed in Appendix F.

Additional recruitment occurred by utilizing the DRU listserv to increase the number of responses in the study. I sent correspondence to the DRU listserv to research potential respondents on June 18, July 9, August 8, and September 15, 2018. The link in the email sent to the listserv contained an anonymous Uniform Resource Locator (www.emonlinesurvey.com) to the survey. Respondents could begin and finish the instrument later if they used the same device and browser. Appendix G contains a sample email invitation to participate in the study, sent to the listserv. On June 13, 2018, I sent a series of emails to state emergency management associations, requesting that they send my survey to their email distribution list. The invitation also contained an anonymous

link to the survey. Appendix H presents a sample email sent to state emergency management associations.

As an incentive, the first 50 completed survey participants received a $5 Target gift card. All completions were entered in a drawing. One selected respondent received a $250 Amazon gift card. The incentives were used to increase the number of survey responses while not exerting a substantial effect on the data quality (Singer & Ye, 2013). Additionally, according to Singer and Ye (2013), incentives increase survey participation for those who might not otherwise respond, thus reducing the possibility of nonresponse errors. Gift cards were electronic gift cards delivered by email. The survey instrument collected contact information if the respondent opted to receive the incentive or enter the drawing. I distributed no further invitations after September 2018. All responses were closed during December 2018.

3.3.4 Analysis of Natural Disaster Preparedness Performance (Outputs)

I recoded several variables to construct an additive index and perform factor analysis. The first variables processed related to natural disaster preparedness outputs. Outputs are easier to measure than outcomes. An additive index of all items was constructed; a factor analysis was then performed to address dimensionality.

3.3.4.1 Coding

I coded choices for answering question 6.1 (“During the past three years, how many different times has a representative of your organization participated in the following?”) into four variables for past emergency management training, past natural disaster training, past emergency management exercises, and past natural disaster

exercises, respectively. Values for the variables ranged from zero to four (see Tables 3a—3d).

Table 3a. Number of Past Emergency Management Training Sessions

Past Emergency Management Training				
Training Sessions	Coded Value	Frequency	Percent	Cumulative
None	0	1	0.71	0.71
1 to 3	1	29	20.71	21.43
4 to 6	2	38	27.14	48.57
7 to 9	3	16	11.43	60.00
10 or more	4	56	40.00	100

Table 3b. Number of Past Natural Disaster Training Sessions

Past Natural Disaster Training				
Training Sessions	Coded Value	Frequency	Percent	Cumulative
None	0	7	5.00	5.00
1 to 3	1	42	30.00	35.00
4 to 6	2	41	29.29	64.29
7 to 9	3	15	10.71	75.00
10 or more	4	35	25.00	100

Table 3c. Number of Past Emergency Management Exercises

Past Emergency Management Exercises				
Exercise Sessions	Coded Value	Frequency	Percent	Cumulative
None	0	4	2.86	2.86
1 to 3	1	47	33.57	36.43
4 to 6	2	43	30.71	67.14
7 to 9	3	14	10.00	77.14
10 or more	4	32	22.86	100

Table 3d. Number of Past Natural Disaster Exercises

Past Natural Disaster Exercises				
Exercise Sessions	Value	Frequency	Percent	Cumulative
None	0	18	12.86	12.86
1 to 3	1	60	42.86	55.71
4 to 6	2	31	22.14	77.86
7 to 9	3	9	6.43	84.29
10 or more	4	22	15.71	100

Question 6.2 ("During the coming year, how often will a representative of your organization participate in the following?") was arranged into four variables for future emergency management training, future natural disaster training, future emergency management exercises, and future natural disaster exercises. Values for this set of variables varied between zero and four (see Tables 4a to 4d).

Table 4a. Number of Future Emergency Management Training Sessions

Future Emergency Management Training				
Training Sessions	Value	Frequency	Percent	Cumulative
None	0	2	1.43	1.43
1	1	17	12.14	13.57
2	2	32	22.86	36.43
3	3	15	10.71	47.14
4 or more	4	74	52.86	100

Table 4b. Number of Future Natural Disaster Training Sessions

Future Natural Disaster Training				
Training Sessions	Value	Frequency	Percent	Cumulative
None	0	4	2.86	2.86
1	1	32	22.86	25.71
2	2	41	29.29	55.00
3	3	17	12.14	67.14
4 or more	4	46	32.86	100

Table 4c. Number of Future Emergency Management Exercises

Future Emergency Management Exercises				
Exercise Sessions	Value	Frequency	Percent	Cumulative
None	0	2	1.43	1.43
1	1	28	20.00	21.43
2	2	51	36.43	57.86
3	3	17	12.14	70.00
4 or more	4	42	30.00	100

Table 4d. Number of Future Natural Disaster Exercises

Future Natural Disaster Exercises				
Exercise Sessions	Value	Frequency	Percent	Cumulative
None	0	13	9.29	9.29
1	1	38	27.14	36.43
2	2	51	36.43	72.86
3	3	10	7.14	80
4 or more	4	28	20	100

I reordered and combined choices for answering question 6.3 ("Regarding your institution's emergency management plans that include natural disaster preparedness, which of the following plans does your institution have?") and question 6.4 ("How long has it been since the following plans have been reviewed and updated?") into 11 variables, one for each emergency plan type. The plan variables fluctuated from zero to six (see Tables 5a to 5k). I discarded the "other" category that allowed for text entry because there were minimal entries. I evaluated the missing observations for respondents who answered all but one or two of the plan questions. Different representatives responded from the same university for several cases. I used those duplicate observations to code the missing cases to keep as many responses as possible.

Table 5a. Current State of Institution's Strategic Plan

Strategic Plan				
Current State of Plan	Value	Frequency	Percent	Cumulative
No plan	0	25	17.86	17.86
Natural disaster not included	1	18	12.86	30.71
Drafting plan	2	18	12.86	43.57
Plan revised > 60 months	3	1	0.71	44.29
Plan revised 37-60 months	4	8	5.71	50.00
Plan revised 12-36 months	5	22	15.71	65.71
Plan revised < 12 months	6	48	34.29	100

Table 5b. Current State of Institution's Emergency Operations Plan

Emergency Operations Plan				
Current State of Plan	Value	Frequency	Percent	Cumulative
No plan	0	3	2.14	2.14
Natural disaster not included	1	2	1.43	3.57
Drafting plan	2	11	7.86	11.43
Plan revised > 60 months	3	3	2.14	13.57
Plan revised 37-60 months	4	3	2.14	15.71
Plan revised 12-36 months	5	34	24.29	40.00
Plan revised < 12 months	6	84	60.00	100

Table 5c. Current State of Institution's Business-Continuity Plan

Business-Continuity Plan				
Current State of Plan	Value	Frequency	Percent	Cumulative
No plan	0	23	16.43	16.43
Natural disaster not included	1	5	3.57	20.00
Drafting plan	2	45	32.14	52.14
Plan revised > 60 months	3	4	2.86	55.00
Plan revised 37-60 months	4	4	2.86	57.86
Plan revised 12-36 months	5	17	12.14	70.00
Plan revised < 12 months	6	42	30.00	100

Table 5d. Current State of Institution's Continuity-of-Operations Plan

Continuity-of-Operations Plan				
Current State of Plan	Value	Frequency	Percent	Cumulative
No plan	0	22	15.71	15.71
Natural disaster not included	1	2	1.43	17.14
Drafting plan	2	46	32.86	50.00
Plan revised > 60 months	3	2	1.43	51.43
Plan revised 37-60 months	4	5	3.57	55.00
Plan revised 12-36 months	5	22	15.71	70.71
Plan revised < 12 months	6	41	29.29	100

Table 5e. Current State of Institution's Natural Hazard-Mitigation Plan

Natural Hazard-Mitigation Plan				
Current State of Plan	Value	Frequency	Percent	Cumulative
No plan	0	35	25.00	25.00
Natural disaster not included	1	3	2.14	27.14
Drafting plan	2	30	21.43	48.57
Plan revised > 60 months	3	5	3.57	52.14
Plan revised 37-60 months	4	7	5.00	57.14
Plan revised 12-36 months	5	21	15.00	72.14
Plan revised < 12 months	6	39	27.86	100

Table 5f. Current State of Institution's Recovery Plan

Recovery Plan				
Current State of Plan	Value	Frequency	Percent	Cumulative
No plan	0	41	29.29	29.29
Natural disaster not included	1	5	3.57	32.86
Drafting plan	2	53	37.86	70.71
Plan revised > 60 months	3	3	2.14	72.86
Plan revised 37-60 months	4	3	2.14	75.00
Plan revised 12-36 months	5	12	8.57	83.57
Plan revised < 12 months	6	23	16.43	100

Table 5g. Current State of Institution's Exercise and Training Plan

Exercise and Training Plan				
Current State of Plan	Value	Frequency	Percent	Cumulative
No plan	0	27	19.29	19.29
Natural disaster not included	1	2	1.43	20.71
Drafting plan	2	42	30.00	50.71
Plan revised > 60 months	3	3	2.14	52.86
Plan revised 37-60 months	4	1	0.71	53.57
Plan revised 12-36 months	5	16	11.43	65.00
Plan revised < 12 months	6	49	35.00	100

Table 5h. Current State of Institution's Threat Hazard Identification Risk Assessment Plan

Threat Hazard Identification Risk Assessment Plan				
Current State of Plan	Value	Frequency	Percent	Cumulative
No plan	0	13	9.29	9.29
Natural disaster not included	1	4	2.86	12.14
Drafting plan	2	24	17.14	29.29
Plan revised > 60 months	3	8	5.71	35.00
Plan revised 37-60 months	4	6	4.29	39.29
Plan revised 12-36 months	5	31	22.14	61.43
Plan revised < 12 months	6	54	38.57	100

Table 5i. Current State of Institution's Communication Plan

Communication Plan				
Current State of Plan	Value	Frequency	Percent	Cumulative
No plan	0	5	3.57	3.57
Natural disaster not included	1	2	1.43	5.00
Drafting plan	2	22	15.71	20.71
Plan revised > 60 months	3	1	0.71	21.43
Plan revised 37-60 months	4	8	5.71	27.14
Plan revised 12-36 months	5	28	20.00	47.14
Plan revised < 12 months	6	74	52.86	100

Table 5j Current State of Institution's Storm Ready Hazardous Weather Plan

Storm Ready Hazardous Weather Plan				
Current State of Plan	Value	Frequency	Percent	Cumulative
No plan	0	28	20.00	20.00
Natural disaster not included	1	3	2.14	22.14
Drafting plan	2	26	18.57	40.71
Plan revised > 60 months	3	5	3.57	44.29
Plan revised 37-60 months	4	7	5.00	49.29
Plan revised 12-36 months	5	23	16.43	65.71
Plan revised < 12 months	6	48	34.29	100

Table 5k Current State of Institution's Campus Evacuation Plan

Campus Evacuation Plan				
Current State of Plan	Value	Frequency	Percent	Cumulative
No plan	0	16	11.43	11.43
Natural disaster not included	1	1	0.71	12.14
Drafting plan	2	28	20.00	32.14
Plan revised > 60 months	3	5	3.57	35.71
Plan revised 37-60 months	4	6	4.29	40.00
Plan revised 12-36 months	5	24	17.14	57.14
Plan revised < 12 months	6	60	42.86	100

Question 6.5 ("During the past three years, how many times has your institution activated its emergency operations center [EOC]?") was classified into two variables for emergency operations center (EOC) activations for natural disasters and all other events. The range for these EOC variables was zero to seven (see Tables 6a to 6b). When the number of EOC activations for natural disasters was missing, I coded each instance as no activations for cases where the number of activations of the EOC for any event was entered. The purpose of recoding these four occurrences was to keep as many responses as possible.

Table 6a Number of EOC Activations for Events Other Than Natural Disasters

EOC - All Other Activations				
Activations	Value	Frequency	Percent	Cumulative
No EOC facilities	0	16	11.43	11.43
No Activations	1	28	20.00	31.43
1 Activation	2	22	15.71	47.14
2 Activations	3	19	13.57	60.71
3 Activations	4	12	8.57	69.29
4 Activations	5	9	6.43	75.71
5 Activations	6	6	4.29	80.00
6 or more activations	7	28	20.00	100

Table 6b Number of EOC Activations for Natural Disasters

EOC - Natural Disasters				
Activations	Value	Frequency	Percent	Cumulative
No EOC facilities	0	19	13.57	13.57
No Activations	1	63	45.00	58.57
1 Activation	2	16	11.43	70.00
2 Activations	3	17	12.14	82.14
3 Activations	4	8	5.71	87.86
4 Activations	5	7	5.00	92.86
5 Activations	6	5	3.57	96.43
6 or more activations	7	5	3.57	100

I coded choices for answering question 6.6 ("During the past three years, how many natural disaster preparedness awareness events has your institution conducted involving the following?") into three variables for public awareness outreach programs run on campus for students, faculty, and staff, respectively. The outreach variables varied between zero to six (see Tables 7a to 7c).

Table 7a Natural Disaster Awareness Programming Delivered to Students

Natural Disaster Awareness Program Delivery to Students				
Programs Delivered	Value	Frequency	Percent	Cumulative
No public-awareness program	0	20	14.29	14.29
No Programs delivered	1	20	14.29	28.57
1 to 2 Programs delivered	2	41	29.29	57.86
3 to 4 Programs delivered	3	29	20.71	78.57
5 to 6 Programs delivered	4	14	10.00	88.57
7 to 8 Programs delivered	5	3	2.14	90.71
9 or more programs delivered	6	13	9.29	100

Table 7b Natural Disaster Awareness Programming Delivered to Faculty

Natural Disaster Awareness Program Delivery to Faculty				
Programs Delivered	Value	Frequency	Percent	Cumulative
No public-awareness program	0	18	12.86	12.86
No Programs delivered	1	18	12.86	25.71
1 to 2 Programs delivered	2	45	32.14	57.86
3 to 4 Programs delivered	3	36	25.71	83.57
5 to 6 Programs delivered	4	10	7.14	90.71
7 to 8 Programs delivered	5	2	1.43	92.14
9 or more programs delivered	6	11	7.86	100

Table 7c Natural Disaster Awareness Programming Delivered to Staff

Natural Disaster Awareness Program Delivery to Staff				
Programs Delivered	Value	Frequency	Percent	Cumulative
No public-awareness program	0	15	10.71	10.71
No Programs delivered	1	12	8.57	19.29
1 to 2 Programs delivered	2	48	34.29	53.57
3 to 4 Programs delivered	3	34	24.29	77.86
5 to 6 Programs delivered	4	11	7.86	85.71
7 to 8 Programs delivered	5	5	3.57	89.29
9 or more programs delivered	6	15	10.71	100

Question 6.7 (“Do you have any Memorandums of Understanding [MoUs] or Mutual aid agreements [MAAs] with the following?”) was categorized into four variables for entities with which the institution has MoUs and MAAs, ranging from zero to two (see Tables 8a to 8d). I did not use the National Intercollegiate Mutual Aid Agreement (NIMAA) and other MAAs in the scale. NIMAA is essentially the same as an agreement with other colleges and universities outside of the state. The NIMAA variable is included in the survey for future research. For the other MAA category, few entries differed from the other listings. Each variable will be incorporated into the additive index for natural disaster preparedness. For missing observations, if there was an answer for state, county, in-state, or out-of-state, I classified the missing observations as “no” to keep as many observations as possible.

Table 8a Colleges and Universities Having an MoU or MAA with Their State

MoU/MAA with State				
MoU/MAA Status	Value	Frequency	Percent	Cumulative
No	0	71	50.71	50.71
Drafting document	1	6	4.29	55.00
Yes	2	63	45.00	100

Table 8b Colleges and Universities Having an MoU or MAA with Their County

MoU/MAA with County				
MoU/MAA Status	Value	Frequency	Percent	Cumulative
No	0	57	40.71	40.71
Drafting document	1	7	5.00	45.71
Yes	2	76	54.29	100

Table 8c Colleges and Universities Having an MoU or MAA with Another School in Their State

MoU/MAA with Higher Education Institution In-state				
MoU/MAA Status	Value	Frequency	Percent	Cumulative
No	0	65	46.43	46.43
Drafting document	1	12	8.57	55.00
Yes	2	63	45.00	100

Table 8d Colleges and Universities Having an MoU or MAA with Another School outside Their State

MoU/MAA with Higher Education Institution Out-of-state				
MoU/MAA Status	Value	Frequency	Percent	Cumulative
No	0	119	85.00	85.00
Drafting document	1	2	1.43	86.43
Yes	2	19	13.57	100

Coding for all variables is in a positive direction. Zeros represent fewer preparedness outputs, while higher numbers represent more preparedness outputs. The descriptive statistics appear in Table 9.

Table 9 Descriptive Statistics – Variables in Natural Disaster Preparedness Scale

Variable Name	Obs.	Mean	Std. Dev.	Min	Max
Past emergency management training	140	2.693	1.217	0	4
Past natural disaster training	140	2.207	1.255	0	4
Future emergency management training	140	3.014	1.175	0	4
Future natural disaster training	140	2.493	1.244	0	4
Past emergency management exercises	140	2.164	1.203	0	4
Past natural disaster exercises	140	1.693	1.246	0	4
Future emergency management exercises	140	2.493	1.160	0	4
Future natural disaster exercises	140	2.014	1.235	0	4
Strategic plan	140	3.479	2.415	0	6
Emergency operations plan	140	5.136	1.475	0	6
Business continuity plan	140	3.286	2.261	0	6
Continuity of operations plan	140	3.400	2.231	0	6
Natural hazard mitigation plan	140	3.179	2.391	0	6
Recovery plan	140	2.357	2.149	0	6
Exercise and training plan	140	3.379	2.367	0	6
Threat hazard identification risk assess plan	140	4.136	2.065	0	6
Communication plan	140	4.750	1.763	0	6
Storm ready hazardous weather plan	140	3.579	2.360	0	6
Campus evacuation plan	140	4.114	2.153	0	6
EOC activations all events	140	3.243	2.429	0	7
EOC natural disasters	140	1.986	1.811	0	7
Natural disaster programming delivered to students	140	2.414	1.688	0	6
Natural disaster programming delivered to faculty	140	2.371	1.566	0	6
Natural disaster programming delivered to staff	140	2.636	1.650	0	6
MoU/MAA with state	140	0.943	0.980	0	2
MoU/MAA with county	140	1.136	0.969	0	2
MoU/MAA with institution in-state	140	0.986	0.960	0	2
MoU/MAA with institution out-of-state	140	0.286	0.692	0	2
Natural disaster preparedness scale std. mean	140	0.000	0.501	-1.229	1.104

3.3.4.2 Additive Index

I calculated and tested the additive index using Stata 14. The scale was formed using casewise deletion and standardization of the means. Cronbach's alpha measures the internal consistency of a measure to determine whether the items are measuring the same

construct. A Cronbach's alpha of 0.70 or higher is regarded as adequate, 0.80 to 0.89 is interpreted as very good, and over 0.90 is considered highly reliable (Multon & Coleman 2010). The 28 variables used to form an additive scale to represent natural disaster preparedness have a reliability score of 0.89, meaning that the scale has very good reliability. In addition, the alpha of each item was above 0.88, and all measured the construct in a positive direction; therefore, there was no reason to remove any questions. Table 10 lists the alpha and direction by item. The additive index yielded 140 observations.

Table 10 Internal Consistency Results for Natural Disaster Preparedness Scale

Variable Name	Obs.	Sign	Item-Test Correlation	Item-Rest Correlation	Average Interitem Correlation	Alpha
Past emergency management training	140	+	0.612	0.565	0.219	0.883
Past natural disaster training	140	+	0.703	0.665	0.216	0.881
Future emergency management training	140	+	0.568	0.517	0.221	0.884
Future natural disaster training	140	+	0.624	0.577	0.219	0.883
Past emergency management exercises	140	+	0.587	0.538	0.220	0.884
Past natural disaster exercises	140	+	0.653	0.609	0.218	0.882
Future emergency management exercises	140	+	0.639	0.594	0.218	0.883
Future natural disaster exercises	140	+	0.615	0.568	0.219	0.883
Strategic plan	140	+	0.394	0.332	0.228	0.889
Emergency operations plan	140	+	0.507	0.451	0.223	0.886
Business continuity plan	140	+	0.529	0.475	0.222	0.885
Continuity of operations plan	140	+	0.491	0.434	0.224	0.886
Natural hazard mitigation plan	140	+	0.487	0.429	0.224	0.886
Recovery plan	140	+	0.503	0.447	0.224	0.886
Exercise and training plan	140	+	0.518	0.463	0.223	0.886
Threat hazard identification risk assess plan	140	+	0.493	0.436	0.224	0.886
Communication plan	140	+	0.352	0.287	0.230	0.889
Storm ready hazardous weather plan	140	+	0.488	0.431	0.224	0.886
Campus evacuation plan	140	+	0.214	0.145	0.235	0.892
EOC activations all events	140	+	0.436	0.376	0.226	0.888
EOC natural disasters	140	+	0.459	0.400	0.225	0.887
Natural disaster programming delivered to students	140	+	0.644	0.599	0.218	0.883
Natural disaster programming delivered to faculty	140	+	0.610	0.562	0.219	0.884
Natural disaster programming delivered to staff	140	+	0.668	0.625	0.217	0.882
MoU/MAA with state	140	+	0.379	0.315	0.228	0.889
MoU/MAA with county	140	+	0.278	0.210	0.233	0.891
MoU/MAA with institution in-state	140	+	0.380	0.317	0.228	0.889
MoU/MAA with institution out-of-state	140	+	0.206	0.136	0.235	0.893
Test scale = mean (standardized items)					0.224	0.890

3.3.4.3 Exploratory Factor Analysis

I conducted an exploratory factor analysis (EFA) of these data to include dimensionality to the scale. In performing this analysis, natural disaster preparedness was partitioned into four constructs: planning, training and exercise, internal awareness, and collaboration. These represent four dependent variables in four different models using the factor scores yielded by the following analysis. Table 11 indicates the descriptive statistics for the four constructs of natural disaster preparedness, which correspond neatly to questions in the survey.

Table 11 Descriptive Statistics for Four Constructs of Natural Disaster Preparedness

Variable Names	Obs.	Mean	Std. Dev.	Min	Max
Exercise and training	140	0.00	0.98	-2.48	2.21
Internal awareness programming	140	0.00	0.93	-1.83	2.58
Planning	140	0.00	0.93	-3.41	2.84
External collaboration	140	0.00	0.84	-1.69	2.64

The Factortest Stata module by Azevado (2006) performs Bartlett's test for sphericity and calculates the Kaiser Meyer-Olkin Measure of Sampling Adequacy (KMO). I ran the test for the 28 variables included in the scale. For Bartlett's test for sphericity, the null hypothesis is that the intercorrelation matrix is based on a population in which the variables are noncollinear and the non-zero correlations in the sample matrix are due to a sampling error. The test yields a p-value of less than 0.001, which is statistically significant; thus, we can reject the null hypothesis for Bartlett's test of sphericity (Bartlett, 1950; Howard, 2016). The KMO is an index for comparing the magnitudes of the observed correlation coefficients with the sizes of the partial correlation coefficients. Large values greater than 0.60 for the KMO measure indicate that a factor analysis of the variables can be performed (Howard, 2016; Kaiser, 1970).

The KMO value for the variables included in the scale is 0.78, which is acceptable to use and proceed with EFA.

Additionally, the sample size is between a 5:1 and 20:1 participant-to-variable ratio, sufficient for using EFA (Costello & Osborne, 2005; Velicer & Fava, 1998). After excluding duplicates, interviewees, and observations with missing data, the sample size was 140. The number of variables used in the scale was 28. The participant-to-variable ratio for these data was five-to-one. However, one limitation of this technique is the argument that there should be a minimum sample size of 200 (Howard, 2016; MacCallum, Widaman, Zhang, & Hong, 1999). Howard (2016) concedes that a minimum of 200 cases is conservative and may not apply to all EFA applications. Andrews, Boyne, Law, and Walker (2009) conducted an EFA using 90 public-service organizations for their article exploring the effect of an interaction between organizational strategy and centralization on performance.

For the factor analytic method, principal axis factoring (PAF) provides results concerning latent constructs. I opted for this form of EFA because it allows for accurate results in most situations (Howard, 2016). Stata calculates factors based on PAF as the default, using the abbreviation "pf." Additionally, the other options, namely principal component analysis (PCA) and maximum likelihood (ML), have drawbacks. According to Fabrigar and Wegener (2012), ML is more likely to produce inaccurate solutions relative to PAF, as in the case of these data using ML yields factor loadings greater than one. There are also stricter assumptions concerning ML that do not apply to PAF (Howard, 2016). PCA is not an appropriate choice for this application. PCA is strictly a data-reduction technique, is not regarded as true factor analysis, and does not provide

results concerning latent constructs (Fabrigar & Wegener, 2012; Howard, 2016). I analyzed these data to create a scale to capture a measure for natural disaster preparedness, or a latent variable. In addition, the constructs that the EFA reported were consistent with expected areas of natural disaster preparedness. Thus, for the above reasons, PAF was an acceptable factor analytic method.

The Kaiser (1960) criterion suggests that factors with an eigenvalue of more than one should be retained. Using the Kaiser approach with these data, one should save four elements that explain 82.45% of the variance. It is also wise to consider the visual scree plot (VSP) (Howard, 2016). Zoski and Jurs (1996) find that using VSP analysis is accurate. Using a scree plot, I looked for an "elbow" where the decreases between the number of factors became less noticeable and determined that I should keep four elements. Figure 5 below illustrates the y-line drawn at the eigenvalue of one. I saved four factors.

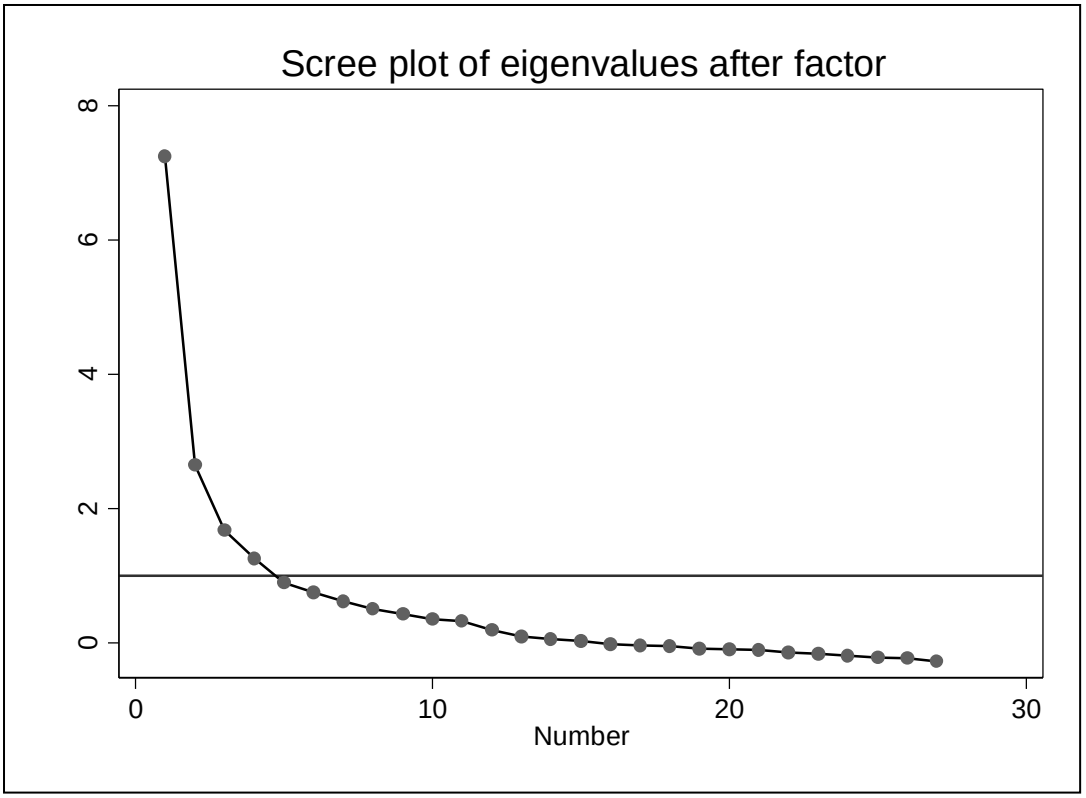

Figure 5. Scree plot of eigenvalues after factoring

Initial factor analysis without rotation was not seamless to interpret with clear factor loadings. Fabringar and Wegener (2012) propose that other factor matrices are correct. Rotating the EFA solutions helps with the interpretation of the resulting factor loadings. Oblique rotations allow common factors to be correlated; thus, oblique rotation is a more realistic representation of the data (Fabringar & Wegener, 2012). Rather than promax, I selected direct quartimin rotation. Promax is an indirect method of rotation, while direct quartimin is a direct method. Some methodologists prefer direct quartimin because of the single step to a simple structure; additionally, it is the more commonly used oblique rotation (Fabringar & Wegener, 2012; Howard, 2016;). For the EFA, I used the “rotate, oblique oblimin” command in Stata 14 to execute the direct quartimin oblique rotation for these data.

Howard (2016) implements a 0.40-0.30-0.20 rule regarding factor loading cutoff. According to this rule, acceptable factors should load one of their primary factors above 0.40, not load on an alternative factor above 0.30, and have a difference of at least 0.20 between their primary factor loading and the closest alternative loading (Howard, 2016). Table 12 indicates the factor loadings of these data. Aside from the activation of the (EOC), all of the factor loadings for any event fulfilled the criteria for the 0.40-0.30-0.20 rule. The EOC activation for any event satisfied the 0.40 and 0.30 criteria but missed the 0.20 criterion (0.40 – 0.22 = 0.18). These are conservative criteria, and this one exception is noted as a limitation but not an exclusion of this EFA, as several published research studies use a 0.40 cutoff for factor loadings (Hinkin 1995, 1998; Howard, 2016), and other studies use 0.30 (Costello & Osborne, 2005). For example, Cheng (2019) uses a 0.30 cutoff for his EFA in examining the determinants of why nonprofits participate in co-governance.

Table 12 Factor Loadings for Natural Disaster Preparedness Output Variables

Variable Names	Exercise & Training	Internal Awareness	Planning	Collaboration
Past emergency management training	**0.81**	-0.05	0.01	0.05
Past natural disaster training	**0.78**	0.09	0.03	0.04
Future emergency management training	**0.75**	-0.03	0.09	-0.16
Future natural disaster training	**0.77**	0.10	0.01	-0.13
Past emergency management exercises	**0.78**	-0.04	-0.08	0.20
Past natural disaster exercises	**0.74**	0.16	-0.10	0.12
Future emergency management exercises	**0.83**	-0.06	0.06	-0.03
Future natural disaster exercises	**0.75**	0.03	0.05	-0.07
Strategic plan	-0.18	0.17	**0.42**	0.22
Emergency operations plan	0.20	-0.08	**0.45**	0.14
Business continuity plan	0.03	0.04	**0.62**	0.15
Continuity of operations plan	0.02	-0.01	**0.64**	0.15
Natural hazard mitigation plan	0.00	0.14	**0.59**	-0.14
Recovery plan	-0.04	0.11	**0.60**	0.03
Threat hazard identification risk assess plan	0.18	0.01	**0.50**	-0.16
Communication plan	0.11	-0.15	**0.47**	0.01
Storm ready hazardous weather plan	0.09	0.10	**0.46**	-0.03
Campus evacuation plan	-0.10	-0.06	**0.43**	-0.08
EOC activations all events	0.22	**0.40**	-0.13	0.07
EOC natural disasters	0.09	**0.48**	0.01	-0.01
Natural disaster programming delivered to students	-0.01	**0.87**	0.06	-0.01
Natural disaster programming delivered to faculty	-0.03	**0.91**	-0.02	0.03
Natural disaster programming delivered to staff	0.07	**0.86**	0.02	-0.01
MoU/MAA with state	0.06	0.14	0.00	**0.55**
MoU/MAA with county	0.02	0.00	0.02	**0.60**
MoU/MAA with institution in-state	0.00	0.00	0.17	**0.63**
MoU/MAA with institution out-of-state	-0.02	-0.05	0.05	**0.42**

3.3.5 Analysis of Performance Variables (Outcomes)

I asked several questions to measure natural disaster preparedness outcomes. The first two variables are the count variables: number of days classes were cancelled and number of days campus was closed. The idea behind this measurement is efficiency. The quicker the recovery, the more prepared an institution is. Additional outcomes include the perception of organizational performance and disaster impact. Outcomes are harder to measure than outputs for natural disaster preparedness.

3.3.5.1 Measurement Coding

Four outcome measurements were developed. The question below was employed to measure the perceived effectiveness of the organization during a natural disaster. A range of one (not effective) to five (extremely effective) was utilized to measure performance for each aspect listed. These factors comprised the measurement for perceived performance. The analysis included both an additive scale and factor scores.

Thinking of your most adverse natural disaster in the last three years, please assess how prepared your institution was to deal with the following?

Mitigating for the natural disaster

Planning for the natural disaster

Response to the natural disaster

Recovery from the natural disaster

Activation of the emergency operations center (EOC)

Scale: Not effective at all (1), Slightly effective (2), Moderately effective (3), Very effective (4), Extremely effective (5). (Survey Q8.5)

In the survey request, respondents evaluated the following statement, Q8.2: "Thinking about the natural disaster events that have happened at your institution in the previous three years, please assess the level of adverse impact for the following." This was used to measure the degree of impact of a natural disaster event. Respondents received this question based on Q8.1, listing how many times 10 natural hazards had occurred at the respondent's college or university. I recoded the levels of impact using the following values: 0= no impact, 1=minor impact, 2=moderate impact, 3=major impact, and 4=catastrophic impact. I then calculated the average impact for the events that had occurred.

I combined and hand-coded questions Q8.3— "During the last three years, which of the following actions has your agency undertaken as a result of natural disaster events? (Choose all that apply)"—and Q8.4—Thinking the last three years, approximately how many days was your institution in the following situations due to a natural disaster?" I did this to create separate variables: one for the number of days that decision-makers had closed campus and one for the number of days the school leadership had canceled classes (see the Survey Instrument in Appendix E). These two variables are count variables with several zero-value cases. There were 28 zero cases for days when class was canceled and 47 observations for days when the campus was closed. There was one case of a college or university that did not experience a natural disaster in the past three years. The number of cases for this variable was 139.

3.3.5.2 Performance Additive Scale

The above items yielded an overall additive scale with a Cronbach's alpha of 0.87, using an average inter-item covariance. The perceived performance scale has three

missing cases. Table 13 presents the descriptive statistics for the items used in the scale and the additive index.

Table 13 Descriptive Statistics for Perceived Natural Disaster Preparedness Performance

Variable	Obs.	Mean	Std. Dev.	Min	Max
Mitigation Performance	138	3.07	0.93	1	5
Planning Performance	138	3.38	0.96	1	5
Response Performance	138	3.59	0.81	1	5
Recovery Performance	138	3.48	0.86	1	5
EOC Performance	137	3.10	1.33	1	5
Overall Performance	137	0.00	0.81	-2.47	1.74

3.3.5.3 Performance EFA Factor Scores

Using the Factortest Stata module by Azevedo (2006), I performed Bartlett's (1950) test for sphericity and calculated the Kaiser Meyer-Olkin Measure of Sampling Adequacy (KMO). I ran the test for the five variables included in the scale. For Bartlett's check for sphericity, the test yielded a p-value of less than 0.001, which is statistically significant; thus, we can reject that the intercorrelation matrix is based on a population in which the variables are noncollinear and the non-zero correlations in the sample matrix are due to a sampling error. The KMO value for the variables included in the scale was 0.82, which is meritorious; thus, these data warranted the use of EFA.

Using both the Kaiser (1960) criterion and a scree plot, I sought eigenvalues above one and an "elbow" where the decreases between the number of factors became less noticeable. I retained one factor. For the EFA, I executed the PAF method with the direct quartimin oblique rotation for these data, using Howard's (2016) 0.40-0.30-0.20 rule regarding factor loading cutoff. Factor scores were predicted and saved as a variable named performefa. Table 14 includes the descriptive statistics for the four natural disaster preparedness outcome variables.

Table 14 Descriptive Statistics for Natural Disaster Preparedness Outcome Variables

Descriptive Statistics of Outcome Variables				
Variable	Mean	Standard Deviation	Minimum	Maximum
Effectiveness of Preparedness	0.00	0.94	-2.98	1.93
Average Impact of Natural Disaster	1.27	0.50	0.00	2.50
Days Class Canceled	4.24	3.94	0.00	17.00
Days Campus Closed	3.20	3.64	0.00	15.00

3.3.6 Analysis of Explanatory Variables

Measurements for hierarchy and coordination as elements of structural complexity, centralized decision-making, and fiscal discretion are the main explanatory variables for this study. I collected the main independent variables with an online survey. The instrument operationalized the concept of hierarchy using Q4.5: "If your institution's leadership is assigned level 1, what level in the organizational hierarchy (organizational chart) is the person primarily responsible for natural disaster preparedness assigned? In this case, leadership means policy-making groups such as chancellor and cabinet or president and highest-ranking vice presidents." Table 15 provides information concerning the frequencies for the variable measuring the level of hierarchy.

Table 15 Frequencies for the Hierarchical Level from Leadership

Level of Hierarchy			
Level	Frequency	Percent	Cumulative
1	11	7.86	7.86
2	25	17.86	25.71
3	50	35.71	61.43
4	40	28.57	90.00
5	11	7.86	97.86
6	1	0.71	98.57
7 or more	2	1.43	100

Question Q4.7 ("Do you have direct access to your institution's leadership during the following times? In this case, leadership means policy-making groups such as

chancellor and cabinet or president and highest-ranking vice presidents") and Q4.8 ("Thinking about your direct access to your institution's leadership during the following times, how formalized is the access? In this case, leadership means policy-making groups such as chancellor and cabinet or president and highest-ranking vice presidents") collected information about coordination between representatives responsible for natural disaster preparedness and leadership. The questions were combined to form two categorical variables, one for coordination during nonemergency times and one for coordination during a natural disaster. The coding included categories for whether the coordination, if any, was either formal or informal. Tables 16a and 16b indicate the frequencies of these two variables.

Table 16a Frequencies for Coordination During a Disaster

Coordination During a Natural Disaster			
Categories	Frequency	Percent	Cumulative
No	11	7.91	7.91
Yes - informal norm	44	31.65	39.57
Yes - formal policy	84	60.43	100

Table 16b Frequencies for Coordination During Nonemergent Times

Coordination During Nonemergent Times			
Categories	Frequency	Percent	Cumulative
No	30	21.43	21.43
Yes - informal norm	65	46.43	67.86
Yes - formal policy	45	32.14	100

Question Q5.4 ("Do you control the budgeted funds for the following functions?") measures budgetary discretion for funds directed for emergency management and natural disaster preparedness. Tables 17a. and 17b indicate the frequencies.

Table 17a Frequencies for Budgetary Discretion for Emergency Management

Budgetary Discretion – Emergency Management			
Category	Frequency	Percent	Cumulative
No	69	49.64	49.64
Yes	70	50.36	100

Table 17b Frequencies for Budgetary Discretion for Natural Disaster Preparedness

Budgetary Discretion – Natural Disaster Preparedness			
Category	Frequency	Percent	Cumulative
No	87	62.59	62.59
Yes	52	37.41	100

I operationalized organizational red tape using question Q4.22: "Based on the rating scale below, please rate the following statement: If red tape is defined as burdensome administrative rules and procedures that have negative effects on the institution's effectiveness, how would you assess the level of red tape at your institution?" The unadapted question previously appeared in research by Pandey and Scott (2002). There are no missing cases for organizational red tape. Table 18 indicates the frequencies.

Table 18 Frequencies for Organizational Red Tape

Red Tape			
Category	Frequency	Percent	Cumulative
None at all	1	0.71	0.71
A little	33	23.57	24.29
A moderate amount	70	50.00	74.29
A lot	25	17.86	92.14
A great deal	11	7.86	100.00

Centralized decision-making is operationalized by the following three questions adapted from previous studies by Hall (1963) and Hage and Aiken (1967):

- Q4.11 “Please indicate your level of agreement or disagreement with each of the following statements about your institution as a whole. In this case, leadership means policy-making groups such as chancellor and cabinet or president and highest-ranking vice presidents.

  “Even small matters have to be referred to someone higher up for a final answer.”
- Q4.12 “There can be little action taken here until leadership approves a decision.”
- Q4.13 “The leadership exerts strong control over this institution.”

3.3.6.1 Centralized Decision-Making Additive Index

A total additive scale measuring centralization of decision-making within the organization was created using the three questions above. Cronbach’s alpha equaled 0.84 on the three-item scale. There were no missing cases for these items. Table 19 presents the descriptive statistics for these three items and the index.

Table 19 Descriptive Statistics for the Centralized Decision-Making Items and Index

Centralized Decision-Making				
Variables	Mean	Standard Deviation	Minimum	Maximum
Even small matters have to be referred to someone higher up for a final answer.	2.50	1.85	0	6
There can be little action taken here until leadership approves a decision.	2.59	1.77	0	6
The leadership exerts strong control over this institution.	3.69	1.61	0	6
Centralized decision-making scale	0.00	0.87	-1.70	1.75

3.3.6.2 Centralization EFA Factor Scores

Since there are only three items in this scale, confirmatory factor analysis (CFA) was not performed. If CFA were completed, the results would be a model that was “just-

identified," meaning that it could not be tested (Acock, 2013). Using Factortest, Stata reported that Bartlett's test for sphericity was significant, and the KMO was 0.63; therefore, it is acceptable to conduct an EFA. The Kaiser (1960) criterion and scree plot produced one factor. I used the PAF method with the direct quartimin oblique rotation for my analysis. Using Howard's (2016) 0.40-0.30-0.20 rule, the factor analysis yielded suitable factor loadings. I calculated and stored the factor scores as a variable called centraldmefa.

3.3.7 Description of Control Variables and Secondary Data

I used secondary data for the control variables in my research study. The Indiana University Center for Postsecondary Research (2016) Carnegie Classification of Institutions of Higher Education (CCIHE) Version 14, last updated on February 24, 2017, was used to collect basic information about universities and colleges across the United States, such as enrollment, residential, nonprofit or public, four-year or not four-year schools, region, and urban or rural universities and colleges (see Tables 20a to 20e). Total enrollment represents the number of students enrolled for Fall 2014 at the postsecondary school. CCIHE encompasses all Title IV eligible, degree-granting colleges and universities that are included in the U.S. Department of Education's National Center for Education Statistics (NCES) (2016) Integrated Postsecondary Education Data System (IPEDS). IPEDS collects data from every postsecondary school that participates in the federal student financial aid programs. The information is collected by a mandatory IPEDS survey each year.

Table 20a Descriptive Statistics for the Institution's Residential Status

Residential versus Nonresidential				
Residential Status	Value	Frequency	Percent	Cumulative
Primarily nonresidential - low	0	56	40.00	40.00
Primarily residential - medium	1	48	34.29	74.29
Highly residential - high	2	36	25.71	100

Table 20b Descriptive Statistics for the University Control

Public versus Private Nonprofit*				
Control	Value	Frequency	Percent	Cumulative
Nonprofit	0	51	36.43	36.43
Public	1	89	63.57	100

* Private for-profit IHEs are not included

Table 20c Descriptive Statistics for the Four-Year or Two-Year School

Four-Year versus Not Four-Year				
Degree Type	Value	Frequency	Percent	Cumulative
Not four-year	0	21	15.00	15.00
Four-year	1	119	85.00	100

Table 20d Descriptive Statistics for the College Region

Bureau of Economic Analysis (BEA) Regions				
Region	Value	Frequency	Percent	Cumulative
New England – CT ME MA NH RI VT	1	15	10.71	10.71
Mid-East – DE DC MD NJ NY PA	2	22	15.71	26.43
Great Lakes – IL IN MI OH WI	3	15	10.71	37.14
Plains – IA KS MN MO NE ND SD	4	5	3.57	40.71
Southeast – AL AR FL GA KY LA MS NC SC TN VA WA	5	28	20.00	60.71
Southwest – AZ NM OK TX	6	14	10.00	70.71
Rocky Mountains – CO ID MT UT WY	7	6	4.29	75.00
Far West – CA NV OR WA	8	35	25.00	100

Table 20e Descriptive Statistics for the Urban or Rural Location

Urban versus Rural				
Urbanization	Value	Frequency	Percent	Cumulative
Rural	0	4	2.86	2.86
Urban	1	136	97.14	100

In addition, I used the FEMA Disaster Declarations Summary Open Government Dataset (FEMA, 2017) to collect a count of Presidential Disaster Declarations (PDDs) by county, as of February 2017. The variable for PDDs denotes the total number of declarations in the county where the university or college is located, between 1953 and February 2017. Lastly, I used ATTOM Data Solutions' 2016 U.S. Natural Hazard Housing Risk Index (2016), which contains natural-hazard-risk scores for counties in the United States. The ATTOM Data Solutions' dataset (2016) contains over 3,000 U.S. counties that are indexed based on the risk of six natural hazards: earthquakes, floods, hail, hurricane storm surge, tornadoes, and wildfires. A risk index was created for each of the six natural hazards, with natural-hazard data available from FEMA, USGS, NOAA, NHC, and the U.S. Department of Agriculture Forest Service and Fire Modeling Institute. Each of the six natural hazard indexes was assigned five levels of risk, from "very low" to "very high." The total natural-hazard index represents the sum of six natural-hazard severity scales. Enrollment, natural-hazard risk, and PDDs are continuous variables (see Table 21).

Table 21 Descriptive Statistics for Continuous Control Variables

Continuous Variable Descriptive Statistics				
Variable	Mean	Standard Deviation	Minimum	Maximum
Fall Enrollment 2014	17073.51	13430.86	1300	61642
Natural Hazard Risk	28.32979	22.17415	1.25	101.76
Presidential Disaster Declarations	7.957143	9.044949	0	39

3.4 Ethical Considerations

I collected the data for this study to fulfill a dissertation requirement for the Public Policy program at the University of North Carolina at Charlotte. A doctoral committee oversaw the research project. None of the persons involved with the study had conflicts

of interest or financial interest or received compensation from or held a position in an organization sponsoring this research study. In addition, all persons conducting this research study completed the required human-subjects training to maintain high ethical standards when dealing with subject interactions.

The individual participants in the semistructured interview were employees over the age of 18 of the universities who serve in roles responsible for disaster preparedness. At some universities and colleges, there may be more than one individual participating in the research study if they share the disaster-preparedness role. Vulnerable populations such as children, non-English-speaking individuals, mentally impaired individuals, prisoners, and students did not participate in this study. The research study design defines exclusion criteria as individuals who are under the age of 18 or not responsible for disaster preparedness at the university. The research design for this study does not include any provisions for obtaining any protected health information from a hospital, health care provider, or other entity subject to HIPAA.

To ensure the proper treatment of human subjects, the research study design and procedures for data collection and storage were submitted to the Institutional Review Board (IRB) for approval (see Appendix A). UNC Charlotte's IRB is the committee responsible for ensuring the protection of human subjects during the execution of research studies. The IRB allows for exemptions to full review of specific applications. This study was granted exempt status. An informed consent form was collected for each interview and survey. The informed consent for the semistructured interview is attached in Appendix B. The first question of the questionnaire was the electronic consent form (see Appendix E).

3.5 Limitations

It is important to consider the validity of a research design (Fink, 2003; Girden & Kabacoff, 2011; O'Sullivan, Rassel, Berner, & Taliaferro, 2017). Validity refers to the accuracy and the usefulness of the research. There are different types of validity to consider in empirical research, namely, internal and external. Internal validity is the extent to which a research design can provide evidence to determine that an explanatory variable precipitated a change in a dependent variable. External validity is the extent to which research findings can be applied to the population (Fink, 2003; Girden & Kabacoff, 2011; O'Sullivan et al., 2017).

According to O'Sullivan et al., (2017), the research design for this study is a cross-sectional, nonexperimental, and single-group design. Furthermore, a nonexperimental design does not control for threats to internal validity, specifically, selection bias and response bias. Selection bias is the nonrandom assignment of participants that may result in differences in the dependent variable beyond the measurement of the explanatory and control variables (Fink, 2003; Girden & Kabacoff, 2011; O'Sullivan et al., 2017). The assignment of the explanatory variables in the study is not randomly assigned; thus, variation in the dependent variables could be attributed to other organizational characteristics. The study uses control variables to mitigate this effect; however, there is still unexplained variation in the dependent variables. Response bias is the loss of participants from a survey. Those organizational representatives who complete the survey may be systematically different from those university officials who do not complete the entire survey (Fink, 2003; Girden & Kabacoff, 2011; O'Sullivan et al., 2017). Of the 304

respondents who started the survey, only 198 finished the survey, and even fewer answered every applicable question.

Effects of selection may threaten external validity. Selection effects can occur when participants in a research study are not representative of the entire population (Fink, 2003; Girden & Kabacoff, 2011; O'Sullivan et al., 2017). No truly comprehensive list exists that shows all colleges and universities with a natural disaster preparedness program or an emergency management division. It is difficult to establish which institutions are in the target population. However, as mentioned earlier in the procedures section, efforts were made to reach as much of the target population as possible, to increase response rates, and to encourage those who might not otherwise participate in the survey.

This type of design leads to a statistical association rather than a causal relationship intended to answer why natural disaster preparedness outputs or outcomes occur. According to O'Sullivan et al. (2017), to claim causality, there must be a statistical association between the explanatory and dependent variables, the independent variable must occur before the dependent variable, all other rival explanatory variables must be eliminated, and there must be a theoretical link between the explanatory and dependent variable. While there are controls in the models, a cross-sectional study cannot provide sufficient evidence to exclude all other hypotheses. Nonetheless, this design can yield valuable information, such as baseline information on surveyed institutions and statistical associations between the variables of theoretical interest and the dependent variables (Fink, 2003; Girden & Kabacoff, 2011; O'Sullivan et al., 2017).

Several key variables originate from the same online survey, including the dependent variables. The measurement of performance using self-perception questions potentially creates limitations on findings. Common-source bias occurs when some of the shared statistical variation between two concepts is a product of their common source, such as a survey used to collect the data. It is measurement error that is not random or, as Richard, Simmering, and Sturman (2009) state, "systematic error variance shared among variables measured with and introduced as a function of the same method and/or source" (p. 763). Meier and O'Toole (2012) suggest a few strategies to deal with common-source bias.

The first recommendation is to avoid perceptions of performance as a dependent variable (Meier & O'Toole, 2012). Most of the dependent-variable concepts in this study are not perceptions of performance. The output variables ask about specific numbers of events or states of documents. Also, two outcome variables—number of days classes were canceled, and the number of days campus was closed—are based on the number of occurrences of actual events and not on beliefs or perceptions.

However, two dependent variables are self-perception of organizational performance variables, the perceived performance of natural disaster preparedness and perceived level of impact from a natural disaster. If a researcher uses perception questions, Meier and O'Toole (2012) propose to focus on making the dependent variable specific as to indicators of performance and not general, broad-based questions. The perception of impact falls into this category. Emergency managers assess the impact of a specific natural disaster using tangible items, such as the amount of visual damage, operational disruption, dollar amounts of damage, and expert training. The perception of

preparedness outcome variable for organizational performance limits vagueness by asking about the different aspects of emergency management and a specific event that was observed. Also, the organizational performance in question is not the organization's primary mission; rather, it is a supporting function.

Moreover, George and Pandey (2017) provide evidence that the common-source bias is exaggerated and that a more balanced perspective should be taken. Also, the authors argue that the previous findings of common-source bias are limited in generalizability (George & Pandey, 2017). Even though three out of four of the studies include schools, they are not institutions of higher learning, as in this research. In addition, there is no administrative alternative for any of the variables, as there is no third-party reporting of damage to institutions of higher learning from natural hazards or reporting of preparedness activities. Previous research has proposed that self-reported data can provide valid indicators of organizational characteristics, some including performance (Lincoln & Zeitz, 1980; Moynihan & Pandey, 2005; Pandey & Moynihan, 2006; Pandey & Wright, 2006). Also, archival data available for organizational preparedness performance could be flawed and present other problems that do not present in self-reported data (George & Pandey, 2017).

3.6 Analytical Techniques

To test the hypotheses set out by this research, I used both linear regression and negative binomial regression techniques. It is appropriate to use linear regression. The assumptions for linear regression include: linearity (i.e., the predictors and the outcome variable should have a linear relationship), normality (i.e., errors should be normally distributed), homoscedasticity (i.e., the error variance should be constant), independence

(i.e., the assertion that there is no correlation between the errors associated with one observation and the errors of another observation, no measurement error in the predictor variables, and the model is properly specified). Two additional issues exist. The first issue is one of influence, relating to individual observations exerting undue influence on the coefficients. The second is collinearity, where the predictors are linearly related, which can cause problems in estimating the regression coefficients (Chen, Ender, Mitchell, & Wells, 2003). I tested the assumptions and issues reported as diagnostics with the results. The following equations include the sample models for linear regression of all the output and two of the outcome variables.

E1. Output (exercise, planning, internal, external) = β_1Central Decision + β_2Red Tape + β_3Budget Flexibility + β_4Hierarchy + β_5Coordination + Controls + Intercept

E2. Outcome (impact, effectiveness) = β_1Central Decision + β_2Red Tape + β_3Budget Flexibility + β_4Hierarchy + β_5Coordination + Controls + Intercept

Negative binomial regression assumptions include a dependent variable measured as a count, linearity in model parameters, independence of individual observations, and the multiplicative effects of independent variables. Negative binomial regression has the flexibility of allowing the conditional variance of the dependent variable to be greater than its conditional mean, or overdispersion. This provides greater flexibility in fitting the model to the data (Yang & Berdine, 2015).

Negative binomial regression is fitted using maximum-likelihood estimation. Maximum-likelihood estimation requires a minimum number of observations of 100 and a ratio of 10 observations to each parameter. The small-N maximum-likelihood estimations have not been proved to produce a biased model, just that they remain

untested (Long & Freese, 2014). Previous research used less than a 10:1 ratio, such as the study conducted by Mohr (2015). I tested the assumptions and reported the diagnostics with the findings. The following equation includes the sample model for negative binomial regression of two of the outcome variables.

E3. Number of Days (canceled, delayed) = exp (β_1Central Decision + β_2Red Tape + β_3Budget Flexibility + β_4Hierarchy + β_5Coordination + ln(Natural Hazard Risk) + Controls + Intercept)

3.7 Summary

This methods chapter outlines the procedures for data exploration and measurement analysis of the operationalization of concepts. The research design I used is a correlational, sequential, exploratory mixed-methods design utilizing cross-sectional semistructured interviews to inform the design of a cross-sectional online survey to collect data. While this results in the potential for common-source bias, I have addressed the concerns adequately, considering the difficulty of obtaining such data as these. I propose using linear regression for most of the models. Two models use overly dispersed count variables, so negative binomial regression was used to conduct this analysis.

CHAPTER 4: RESULTS AND ANALYSIS

In this dissertation, I used interviews to create an original survey about higher education and emergency preparedness. In Chapter 3, I outlined the methods used to improve our understanding of organizational structure and budgetary flexibility in relation to natural disaster performance. To analyze the results, I used linear regression and negative binomial regression to answer two main questions. Contingency theory posits that a strategically structured organization will be more effective. To test this idea, the first question addresses how the level of natural disaster preparedness varies with organizational complexity in U.S. colleges and universities. Specifically, the first inquiry poses the question of whether direct (formal) integration coordination and vertical differentiation within an organizational hierarchy affect the level of natural disaster preparedness performance. Additionally, New Public Management (NPM) includes the doctrine of managerialism that emphasizes giving the manager discretion that can improve organizational efficiency and effectiveness. The second question tackles how centralized decision-making, red tape, and budgetary flexibility are associated with natural disaster preparedness performance.

The analysis consisted of four models that measure performance as a form of natural disaster preparedness outputs. The policy process is usually thought of in the framework of the "stages heuristic" found in the works of Theodoulou (1995), Anderson (2006), and Peters (2018). This framework divides the policy process into stages, such as

problem identification, agenda setting, policy formulation, policy adoption, policy implementation, and policy evaluation (Theodoulou, 1995). The stages allow for a systematic approach to studying public policy. The stage in which I am interested is implementation, the bureaucratization of policy, where the action occurs after policy adoption (Hill & Hupe, 2006; Theodoulou, 1995). According to Finkler, Smith, Calabrese, and Purtell (2016) inputs are resources used in producing outputs. Policy outputs are things that are actually done as a result of policymakers' decisions. Policy outcomes are the consequences (intended or unintended) for the public resulting from purposeful organizational action or inaction (Anderson, 2006; Hill & Hupe, 2006).

The outputs for emergency management and natural disaster preparedness include activities such as the state of various plans typically found in emergency management, the number of exercises and training sessions run, the number of awareness events held for students, faculty, and staff, and the existence of certain external collaborations. Four other models include performance determined by preparedness outcomes. The four outcome variables include the number of days that classes were canceled, the number of days the campus was closed, perceived impact of the disaster, and perceived organizational effectiveness of the natural disaster preparedness function. I designed each model to answer my research questions and test their underlying theory. They are further operationalized to address all five hypotheses.

4.1 Hypothesis One

To test the hypothesis that institutions with more hierarchical levels achieve lower levels of natural disaster performance, I first used the model that appears in Table 22. Linear regression is performed on a dependent variable, the factor score from questions

related to natural disaster preparedness training and exercise.[2] Training in natural disaster areas and exercises that simulate scenarios have been suggested as useful tools to measure preparedness efforts (Donahue & Tuohy, 2006; Nelson, Lurie, & Wasserman, 2007; Savoia, Preston, & Biddinger, 2013). The model explained 37% (adjusted R^2= 0.37) of the variation in exercise and training outputs and it was a significant model with 139 observations. Adjusted R^2 reveals how well the regressors predict or explain the values of the dependent variable with the given dataset (Stock & Watson, 2015). However, the adjusted R^2 does not convey whether a variable is statistically significant, the regressors are the cause of the change in the dependent variable, there is omitted variable bias, or an appropriate set of regressors has been chosen (Stock & Watson, 2017). According to Sarstedt and Mooi (2014), there is no clear guidance regarding whether an adjusted R^2 is appropriate. Given that these data are cross-sectional and exploratory, adjusted R^2 values of around 0.10 are typical (Sarstedt & Mooi, 2014). The R^2 for the model in Table 22 is very good, given the nature of the data and the study. Based on the diagnostics of the models, all models were regressed using robust standard errors. Complete diagnostic information for all models appears in Appendix I.

Using Thompson's (1967) levels model and his idea that the open adaptation happens at the higher institutional level, it stands to reason that when dealing with external factors, such as natural disasters, the unit responsible for preparedness would exist at a higher institutional level. Thus, one would expect increasing levels of hierarchy between the preparedness function and leadership to reduce performance (Anderson,

[2] These scores were factored on the following two questions. Question 6.1 "During the past three years, how many different times has a representative of your organization participated in the following?" and Question 6.2 "During the coming year, how often will a representative of your organization participate in the following?"

1969; Gillespie & Streeter, 1987; Kapucu & Khosa, 2013; Velazquez, Munguia, & Sanchez, 2005). Based on the model in Table 22, I found no support for my first hypothesis that preparedness performance varied significantly by hierarchy in this model. However, the variable measuring hierarchy was in the theoretically expected direction. It was not statistically significant using a two-tailed test with an alpha of 0.10.[3]

Increasing the alpha increases the power, advantageous given the small sample size. However, it increases the probability of a Type I error occurring. A Type I error is rejection of the null hypothesis when it is actually true (O'Sullivan et al., 2017). The null hypothesis for this research hypothesis is that institutions with more hierarchy have the same or greater levels of natural disaster performance compared to those with no or fewer levels of hierarchy. For this hypothesis, a Type I error would be not rejecting the association of increased hierarchy reduced performance levels when, in fact, institutions with more levels of hierarchy have the same or increased levels of natural disaster preparedness performance. The use of less conservative alphas is justifiable and widely used in numerous articles published in high-impact-factor, peer-reviewed journals (Mohr, 2016; Schumm, Pratt, Hartenstein, Jenkins, & Johnson, 2013). Thus, I believe this is worth exploring based on the work of La Porte (1996), who argues that natural disaster preparedness needs more flexibility to improve performance as situational complexity increases. During the interviews, many of the professionals mentioned that as their function is located with another function, adding to the complexity of the organization, it

[3] Vertical differentiation was measured using hierarchical levels between the unit responsible for natural-disaster preparedness and leadership. It was operationalized with Question 4.5: "If your institution's leadership is assigned level 1, what level in the organizational hierarchy (organizational chart) is the person primarily responsible for natural disaster preparedness assigned? In this case, leadership means policy-making groups such as chancellor and cabinet or president and highest ranking vice presidents."

is easier or would be easier to prepare if they had the flexibility to coordinate with leadership during nondisaster times.

To further test the hypothesis that institutions with more hierarchy have lower levels of natural disaster performance, based on the work of Thompson (1967) and Scott and Davis (2006), I next considered the model that specifically tests the survey data. This question was created based on interviews with emergency management professionals, some of whom mentioned that having multiple layers in between them and leadership can impede preparedness efforts. This appears in Table 23. Linear regression is performed on a dependent variable that is a factor score from questions related to natural disaster preparedness internal-awareness outputs.[4] The model was not significant, with an F statistic of 1.45. This indicates that other variables may predict the performance outputs of internal-awareness activities for natural disaster preparedness, rather than organizational structure or budgetary flexibility.

The model that appears in Table 24 was also used to test Hypothesis One. I conducted linear regression on a factor score calculated from questions related to natural disaster preparedness external-collaboration outputs yielded from the survey.[5] The model explained 8.1% of the variation in external-collaboration activities and it was a significant model with 139 observations. An adjusted R^2 of less than 0.10 in an exploratory cross-sectional design is not as good as one would hope (Sarstedt & Mooi, 2014), but it does not mean the model is not meaningful. The model is still useful to

[4] There are two questions included in the factors scores for internal awareness outputs. Questions 6.5 "During the past three years, how many times has your institution activated its emergency operations center (EOC)?" and Question 6.6 "During the past three years, how many natural disaster preparedness awareness events has your institution conducted involving the following?"

[5] One question was used to create the factor for external collaborations. Question 6.7 "Do you have any Memorandums of Understanding (MoUs) or Mutual aid agreements (MAAs) with the following?"

evaluate relationships between the regressors and the regressand (Sarstedt M. & Mooi, 2014; Stock & Watson, 2015). I did not find support for Hypothesis One, that preparedness performance varied inversely with hierarchy. The variable measuring hierarchy was not in the expected direction but was not statistically significant.

In the model that appears in Table 25, linear regression was performed on a dependent variable that is a factor score from questions related to natural disaster preparedness planning outputs.[6] The model was not significant, with an F statistic of 0.611. Similar to the model in Table 23, the model in Table 25 suggests that other variables might predict the performance outputs of planning activities for natural disaster preparedness, rather than organizational structure or budgetary flexibility.

In addition to output models, regressions using outcome variables were used to test the hypothesis that hierarchy is negatively associated with natural disaster preparedness levels. The model shown in Table 26 measured preparedness outcomes by the number of days classes were canceled, which is a count variable.[7] This represents a measurement of impact and recovery. How soon a university or college can resume a normal schedule can be a sign of preparedness performance. The model was significant with 138 observations. The Cox-Snell/ML pseudo R^2 was 0.13. This statistic is not the same as R^2 in linear regression. It is merely a measure by which to compare models to determine which one is a better fit (Cameron & Trivedi, 2009). Natural-hazard risk was used as an exposure variable in the negative binomial models. An exposure variable is included as a natural

[6] Two questions were used to develop the planning factor. Question 6.3 "Regarding your institution's emergency management plans that include natural disaster preparedness, which of the following plans does your institution have?" and Question 6.4 "How long has it been since the following plans have been reviewed and updated?"

[7] The dependent variable for models in Tables 26 and 27 was from the survey question 8.4 "Thinking the last three years, approximately how many days was your institution in the following situations due to a natural disaster?"

log in the model with its coefficient constrained to one. An exposure variable controls for varying risk that an event might occur (Cameron & Trivedi, 2009; Long & Freese, 2014). Table 26 displays evidence that failed to support the possibility that more levels of hierarchy did not vary positively with the number of days classes were canceled. The variable measuring hierarchy was neither in the expected direction (according to theory) nor statistically significant. More levels of hierarchy may have impeded communication between the area expert and leadership. This could have led to not canceling classes since leadership may not have been informed by the professionals, due to their separation within the organization. Also, if the natural disaster preparedness function was within another department, there may have been competing agendas demanding the attention of leadership. With the location within another unit being hierarchically lower, the natural-preparedness agenda may have been pushed aside. This may be a mediating variable that plays a role that I will discuss later in Chapter Five.

The model shown in Table 27 measured preparedness outcomes by the number of days an institution's campus was closed. Again, a decrease in this variable would be seen as an improvement in the level of natural disaster preparedness, as better preparedness can lead to a quicker recovery. The model was significant with 138 observations, and the pseudo R^2 was 0.07. I found no support for variation in natural disaster-preparedness performance levels by hierarchy as suggested by Kapucu and Khosa (2013), Velazquez, Munguia, and Sanchez (2005), Gillespie and Streeter (1987), and Anderson (1969). Hierarchy was not significant and was not in the projected direction. Again, the same explanation could be used to explain this opposite-direction result. The additional levels of hierarchy may have encumbered the communication process between the subject-

matter expert and leadership. This could have led to not closing the campus. Placement within another unit may also be a mediating factor.

Table 28 shows another model that I used to test whether levels of natural disaster preparedness varied by hierarchy. As before, I conducted linear regression on a factor score calculated from questions related to natural disaster preparedness outcomes measured by perceived performance factor scores.[8] The perceived performance is based on the opinions of university and college emergency managers. They are the best persons to gauge the level of organizational natural disaster preparedness performance. The model explained 17% of the variation in perceived performance. Table 28 shows the model had 136 observations and was significant. I did not find support for my first hypothesis that preparedness performance is reduced by increased complexity, measured as the number of hierarchical levels within an organization. The variable measuring hierarchy was in the expected direction. However, it was not statistically significant.

In Table 29, Hypothesis One had its final test. An average that measured perceived natural disaster impact of various natural hazards was used as the dependent variable for a linear regression.[9] Based on the 136 observations in the regression model, it was not significant, with an F statistic of 1.42. This model does not fit the data well, given the predictors of interest at this time. I will revisit this in the discussion and conclusion, in the context of my future research plans.

[8] The respondents were asked Question 8.5 "Thinking of your most adverse natural disaster in the last three years, please assess how prepared your institution was for dealing with the following?"
[9] The question used was 8.2 "Thinking about the natural disaster events that have happened at your institution in the previous three years, please assess the level of adverse impact for the following." The average was taken given the types of events that occurred.

4.2 Hypothesis Two

Organizations that adapt their internal structures to meet the demands of their external environments will perform effectively (Donaldson, 2001; Hult, 2012; Lawrence & Lorsch, 1967; Scott & Davis, 2006; Stazyck & Goerdel, 2011). Kettl's (2003) contingent coordination of collaborative networks that include different organizational levels, developed specifically to address critical problems, will perform better than coordination based on rules that rigidly confine managers to their business unit in crisis situations (Bowditch & Buono, 2005; Lawrence & Lorsch, 1967). In their interviews, some professionals revealed that communicating with leadership enables better preparedness. This work, along with other information collected from interviews, informed the creation of the survey question and the second hypothesis—namely, that institutions with direct integration of coordination have higher levels of natural disaster performance.[10] To test this hypothesis, I regressed and examined the eight different models in Tables 22 through 29. Four models used outputs and four used outcomes to measure natural disaster preparedness. Models located in Tables 23, 25, and 29 were not significant models. These models may not represent the predictors that influence internal awareness outputs, planning outputs, and perceived-impact outcomes. I will discuss this further in Chapter 5.

The model in Table 22 supported Hypothesis Two. The coefficient for formal coordination as a measure of direct integration was almost double that of informal coordination. In addition, both coefficients were in the predicted direction, but direct

[10] The measurement for integration of coordination was operationalized by two questions in the survey, Question 4.7 "Do you have direct access to your institution's leadership during the following times?" and Question 4.8 "Thinking about your direct access to your institution's leadership during the following times, how formalized is the access?".

integration was significant while indirect integration was not. This provides evidence that in those organizations that directly integrate coordination between the unit charged with preparedness and leadership, that variable relates to increased exercise and training performance outputs. However, the model in Table 24 shows no association of coordination with external-collaboration outputs. The collaboration variables are in the theoretically predicted direction but are not significant.

Next, I explain outcome measures of preparedness performance, based on the models (see Tables 26 and 27) that operationalized performance as the number of days classes were canceled or the campus was closed. Both direct and indirect integration measured as formal and informal coordination were significant. The signs of coefficients were not in the direction expected. However, formal coordination by policy was slightly better than informal coordination through social norms.

A better-prepared university should have a reduced number of days on which the campus was closed, or classes were canceled. This would represent a reduced impact that would enable regular operations to resume faster by performing better at natural disaster preparedness. However, an opposite finding may be that better coordination with leadership results in action taken to address safety concerns. A less prepared university without coordination between emergency management and leadership overlooks these precautionary measures or delays reacting by canceling classes or closing the campus. Additionally, there may be times where the classes are canceled or campus is closed preemptively, given outside data regarding an impending natural-hazard event that does not transpire or impacts a different area than predicted.

I used perceived performance as an outcome measure in the model shown in Table 28. Direct integration was significant and in the direction theoretically predicted. Indirect integration was also significant and in the expected direction. There was support for Hypothesis Two, namely, that direct integration of coordination of the responsibility center for natural disaster preparedness with leadership was associated with higher levels of natural disaster performance than either indirect integration of coordination or no integration of coordination. According to Bowditch and Buono (2005) and Lawrence and Lorsch (1967), direct integration of coordination consists of formalized roles and networks built to better deal with complex tasks. This describes Kettl's (2003) contingent coordination that includes a collaborative network. Having in place this defined network that includes multiple organizational levels should increase the level of natural disaster preparedness organizational effectiveness. The coefficient of formal coordination was larger than that of indirect coordination and was statistically significant.

4.3 Hypothesis Three

New Public Management draws on managerialism from the private sector as a response to the frustration surrounding the traditional public-administration fixation on centralization (Anderson, 1995; Hood, 1991, 2000; Moynihan & Pandey, 2005). Traditional bureaucratic organizations restrict bottom-up participation in key decision-making. The idea is to decentralize in order to encourage participation, flexibility, and productivity (Christensen & Lægreid, 2011; Hood & Jackson, 1991; Painter, 1988; Pollitt, 1998). Public financial management is important to public administration (Kioko et al., 2011). As a part of financial management, budgetary flexibility, including the ability to make changes, is necessary to achieve the desired level of performance

(Moynihan & Andrews, 2010). Following this reasoning, one would expect institutions that give emergency managers flexibility over their budget to have higher performance in natural disaster preparedness, as Hypothesis Three posits.

To test Hypothesis Three—namely, that having budgetary flexibility will increase preparedness performance levels—I first examined the models that appear in Tables 22 and 24. In Table 22, budgetary flexibility was significant and directly related with natural disaster preparedness performance level, as expected.[11] I formed the question for the survey from interviews with institutional representatives responsible for natural disaster preparedness. Those interviewees without control of their budget stated that there is extra work involved in using money for preparedness. Often, there was not a budgeted line item for emergency management, let alone for natural disaster preparedness. Thus, justifying every expenditure to the person controlling the budget requires an extra step, resulting in less flexibility to divert funds to the most efficient activities. However, Table 24 shows this was just outside significance but not in the anticipated direction. Table 24 deals with the external-collaboration aspect of natural disaster preparedness. This includes MoUs and MAAs that require leadership to sign and carry out final negotiations.[12] Those at the top who push the budgetary responsibility to lower levels may not participate directly in preparedness, and it takes leadership to enter into these external agreements.

I tested Hypothesis Three with the rest of the models. In Table 26, budgetary flexibility was significant and in the direction expected according to theory. Those

[11] Respondents were asked Question 5.4 "Do you control the budgeted funds for the following functions?"
[12] Respondents were asked Question 6.7 "Do you have any Memorandums of Understanding or Mutual aid agreements with the following?"

institutions whose emergency managers had budgetary discretion had associated improved outcomes from natural disaster preparedness. In Tables 27 and 28, I did not find support for the hypothesis that budgetary flexibility was related to improved preparedness outcomes. Budgetary discretion was not significant in either model. However, it was in the direction predicted by theory and previous research. Budgetary flexibility for the person responsible for natural disaster preparedness may have a stronger relationship with whether classes are canceled rather than closing the campus based on an overall assessment. Canceling classes is a lesser action than closing campus for an overall perception of a larger event. For these kinds of intermediary steps, leadership could rely more on the input from the subject-matter expert, whereas the decision to close the campus could require more input from other places in university administration.

4.4 Hypothesis Four

To test if institutions with less centralized decision-making have higher levels of performance in natural disaster preparedness than those with more centralized decision-making, I examined the models in Tables 22, 24, 26, 27, and 28. Theoretically, from the NPM perspective, increased decentralization and managerialism that give managers the freedom to make decisions would increase efficiency and effectiveness, and more centralized organizations would have associated decreases in performance. However, I found no empirical support for variation in natural disaster outputs or outcomes with the degree of centralized decision-making. The same occurred for natural disaster preparedness performance varying with centralization. One possible explanation is that while Moynihan and Pandey (2005) find that centralization decreases organizational

effectiveness, the other research conducted found no statistical relationship between centralization and organizational effectiveness (Andrews et al., 2009; Schmid, 2002).

4.5 Hypothesis Five

Theoretically, NPM advocates for giving the manager discretion to manage, which will lead to better organizational performance (Christensen & Lægreid, 2011; Hood, 1991). The traditional approach to public administration expected managers to implement and follow the orders of elected officials, given that most administrators are hired based on merit, and politics should be separated from administration (Hood, 1991, 2000). Empirically, previous research (Brewer & Walker, 2010; Walker & Brewer, 2009) finds that organizational-level red tape is associated with a reduction in organizational performance. These ideas and results lead to Hypothesis Five, namely, that institutions with less organizational red tape have an increased level of performance in natural disaster preparedness than those with more organizational red tape.

In the models displayed in Tables 22, 24, 26, and 27, I found support for Hypothesis Five; i.e., red tape was negatively associated with natural disaster preparedness performance levels. In Table 22, preparedness performance was measured by exercise and training outputs. The increase in the coefficient of red tape was associated with a decrease in preparedness exercise and training outputs. The model in Table 24 also shows that an increase in red tape was related to a reduction in external collaboration activities. Additionally, for the outcome models measured by the number of days that classes were canceled or the campus was closed, an increase in red tape correlated to an increase in the number of days classes were canceled and the number of days the campus was closed. Performance outcomes measured as a reduction in the

number of days would mean a quicker return to normal operations, an indicator of a good outcome.

4.6 Summary

In this chapter, results were reported for the quantitative analysis. Each hypothesis was addressed by the four output models and the four outcome models. Linear and negative binomial regression models were evaluated with both visual and statistical diagnostic tests, where applicable. The next chapter includes a discussion of these results, their implications, and conclusions as they relate to the hypotheses.

Table 22 Factors Influencing Natural Disaster Exercise and Training Outputs

Variables	**Coefficient**	**Error**
Centralized Decision-Making	-0.040	(0.089)
Control of Budget (0= No) (Indicator)		
Control of Budget (1= Yes)	**0.426****	**(0.153)**
Red Tape	**-0.149**$^{+}$	**(0.095)**
Hierarchy	-0.085	(0.068)
Coordination (0=No) (Indicator)		
Coordination (1=Yes, Informal Norm)	0.292	(0.177)
Coordination (2=Yes, Formal Policy)	**0.417***	**(0.182)**
Fall 2014 Enrollment (0000)	**0.304*****	**(0.065)**
Not a Four-Year Institution (Indicator)		
Four-Year Institution	0.203	(0.275)
Nonprofit Institution (Indicator)		
Public Institution	0.121	(0.145)
On-Campus Residential Status		
Low (Indicator)		
Medium	**0.489***	**(0.195)**
High	-0.119	(0.220)
Number of Presidential Disaster Declarations	-0.004	(0.008)
Natural Hazard Risk Score	**0.006***	**(0.003)**
Intercept	**-0.957***	**(0.385)**
N	139	
F (13, 125)	7.38	
Prob > F	0.000	
Adjusted R^2	0.370	

$^{***}p \leq .001$, $^{**}p \leq .01$, $^{*}p \leq .05$, $^{+}p \leq .10$
Two-tailed significance and robust standard errors
Bold indicates significant coefficients

Table 23 Factors Influencing Natural Disaster Internal Awareness Outputs

Variables	**Coefficient**	**Error**
Centralized Decision-Making	-0.000	(0.095)
Control of Budget (0= No) (Indicator)		
Control of Budget (1= Yes)	0.039	(0.185)
Red Tape	-0.018	(0.114)
Hierarchy	-0.066	(0.072)
Coordination (0=No) (Indicator)		
Coordination (1=Yes, Informal Norm)	0.295	(0.237)
Coordination (2=Yes, Formal Policy)	0.343	(0.262)
Fall 2014 Enrollment (0000)	0.023	(0.062)
Not a Four-Year Institution (Indicator)		
Four-Year Institution	-0.314	(0.292)
Nonprofit Institution (Indicator)		
Public Institution	**-0.413**$^{+}$	**(0.240)**
On-Campus Residential Status		
Low (Indicator)		
Medium	0.015	(0.205)
High	-0.357	(0.264)
Number of Presidential Disaster Declarations	**0.019***	**(0.009)**
Natural Hazard Risk Score	-0.001	(0.004)
Intercept	0.433	(0.557)
N	139	
F (13, 125)	*1.45*	
Prob > F	*0.145*	
Adjusted R^2	0.016	

$^{***}p \leq .001$, $^{**}p \leq .01$, $^{*}p \leq .05$, $^{+}p \leq .10$
Two-tailed significance and robust standard errors
Bold indicates significant coefficients
Italics designates that the model not significant

Table 24 Factors Influencing Natural Disaster External Collaboration Outputs

Variables	**Coefficient**	**Error**
Centralized Decision-Making	0.075	(0.089)
Control of Budget (0= No) (Indicator)		
Control of Budget (1= Yes)	-0.264	(0.160)
Red Tape	**-0.156**$^{+}$	**(0.087)**
Hierarchy	0.092	(0.0733)
Coordination (0=No) (Indicator)		
Coordination (1=Yes, Informal Norm)	0.170	(0.180)
Coordination (2=Yes, Formal Policy)	0.376	(0.234)
Fall 2014 Enrollment (0000)	0.058	(0.056)
Not a Four-Year Institution (Indicator)		
Four-Year Institution	0.287	(0.231)
Nonprofit Institution (Indicator)		
Public Institution	**0.492***	**(0. 199)**
On-Campus Residential Status		
Low (Indicator)		
Medium	0.124	(0.180)
High	**0.461***	**(0.218)**
Number of Presidential Disaster Declarations	-0.001	(0.008)
Natural Hazard Risk Score	0.001	(0.003)
Intercept	**-0.925***	**(0.452)**
N	139	
F (13, 125)	2.13	
Prob > F	0.017	
Adjusted R^2	0.081	

$^{***}p \leq .001$, $^{**}p \leq .01$, $^{*}p \leq .05$, $^{+}p \leq .10$
Two-tailed significance and robust standard errors
Bold indicates significant coefficients

Table 25 Factors Influencing Natural Disaster Planning Outputs

Variables	**Coefficient**	**Error**
Centralized Decision-Making	0.044	(0.101)
Control of Budget (0= No) (Indicator)		
Control of Budget (1= Yes)	-0.242	(0.193)
Red Tape	-0.191	(0.121)
Hierarchy	-0.034	(0.074)
Coordination (0=No) (Indicator)		
Coordination (1=Yes, Informal Norm)	0.115	(0.206)
Coordination (2=Yes, Formal Policy)	0.170	(0.217)
Fall 2014 Enrollment (0000)	0.035	(0.093)
Not a Four-Year Institution (Indicator)		
Four-Year Institution	-0.090	(0.304)
Nonprofit Institution (Indicator)		
Public Institution	**-0.403^{+}**	**(0.243)**
On-Campus Residential Status		
Low (Indicator)		
Medium	-0.197	(0.228)
High	-0.275	(0.271)
Number of Presidential Disaster Declarations	0.005	(0.008)
Natural Hazard Risk Score	-0.000	(0.004)
Intercept	**0.874^{+}**	**(0.453)**
N	139	
F (13,125)	*0.85*	
Prob > F	*0.611*	
Adjusted R^2	-0.018	

$^{***}p \leq .001$, $^{**}p \leq .01$, $^{*}p \leq .05$, $^{+}p \leq .10$
Two-tailed significance and robust standard errors
Bold indicates significant coefficients
Italics designates that the model not significant

Table 26 Factors Influencing Natural Disaster Outcomes – Days Classes Canceled

Variables	**Coefficient**	**Error**
Centralized Decision-Making	-0.186	(0.157)
Control of Budget (0= No) (Indicator)		
Control of Budget (1= Yes)	**-0.418**$^{+}$	**(0.225)**
Red Tape	**0.244**$^{+}$	**(0.142)**
Hierarchy	-0.029	(0.089)
Coordination (0=No) (Indicator)		
Coordination (1=Yes, Informal Norm)	**1.468****	**(0.495)**
Coordination (2=Yes, Formal Policy)	**1.238****	**(0.464)**
Fall 2014 Enrollment (0000)	0.110	(0.089)
Not a Four-Year Institution (Indicator)		
Four-Year Institution	**-0.871***	**(0.436)**
Nonprofit Institution (Indicator)		
Public Institution	-0.034	(0.265)
On-Campus Residential Status		
Low (Indicator)		
Medium	**0.867****	**(0.314)**
High	**1.207*****	**(0.338)**
Number of Presidential Disaster Declarations	-0.016	(0.013)
Intercept	**-2.821*****	**(0.672)**
ln (Natural Hazard Risk Score) (exposure)	1.000	
N	138	
Model *df*	12	
Log Likelihood	-376.189	
AIC	780.379	
WALD	29.214	
Pseudo R2 (Cox-Snell/ML)	0.133	

$^{***}p \leq .001$, $^{**}p \leq .01$, $^{*}p \leq .05$, $^{+}p \leq .10$
Two-tailed significance and robust standard errors
Bold indicates significant coefficients

Table 27 Factors Influencing Natural Disaster Outcomes – Days Campus Closed

Variables	**Coefficient**	**Error**
Centralized Decision-Making	-0.277	(0.185)
Control of Budget (0= No) (Indicator)		
Control of Budget (1= Yes)	-0.208	(0.256)
Red Tape	**0.394** *	**(0.162)**
Hierarchy	-0.083	(0.100)
Coordination (0=No) (Indicator)		
Coordination (1=Yes, Informal Norm)	**1.075** *	**(0.473)**
Coordination (2=Yes, Formal Policy)	**0.904** *	**(0.462)**
Fall 2014 Enrollment (0000)	-0.024	(0.099)
Not a Four-Year Institution (Indicator)		
Four-Year Institution	-0.680	(0.424)
Nonprofit Institution (Indicator)		
Public Institution	0.121	(0.281)
On-Campus Residential Status		
Low (Indicator)		
Medium	0.457	(0.336)
High	0.592	(0.385)
Number of Presidential Disaster Declarations	**-0.030** *	**(0.013)**
Intercept	**-2.655** ***	**(0.726)**
ln (Natural Hazard Risk Score) (exposure)	1.000	
N	138	
Model *df*	12	
Log Likelihood	-329.325	
AIC	686.65	
WALD	20.113	
Pseudo R2 (Cox-Snell/ML)	0.074	

$^{***}p \leq .001$, $^{**}p \leq .01$, $^{*}p \leq .05$, $^{+}p \leq .10$
Two-tailed significance and robust standard errors
Bold indicates significant coefficients

Table 28 Factors Influencing Natural Disaster Outcomes – Perceived Performance

Variables	**Coefficient**	**Error**
Centralized Decision-Making	-0.067	(0.096)
Control of Budget (0= No) (Indicator)		
Control of Budget (1= Yes)	0.197	(0.168)
Red Tape	-0.149	(0.100)
Hierarchy	-0.096	(0.061)
Coordination (0=No) (Indicator)		
Coordination (1=Yes, Informal Norm)	**0.493***	**(0.219)**
Coordination (2=Yes, Formal Policy)	**0.590***	**(0.227)**
Fall 2014 Enrollment (0000)	0.040	(0.067)
Not a Four-year Institution (Indicator)		
Four-Year Institution	**0.497+**	**(0.256)**
Nonprofit Institution (Indicator)		
Public Institution	0.037	(0.205)
On-Campus Residential Status		
Low (Indicator)		
Medium	0.028	(0.226)
High	-0.031	(0.287)
Number of Presidential Disaster Declarations	**0.013+**	**(0.008)**
Natural Hazard Risk Score	-0.000	(0.004)
Intercept	-0.493	(0.492)
N	136	
F (13, 122)	4.080	
Prob > F	0.000	
Adjusted R^2	0.169	

$^{***}p \leq .001$, $^{**}p \leq .01$, $^{*}p \leq .05$, $^{+}p \leq .10$
Two-tailed significance and robust standard errors
Bold indicates significant coefficients

Table 29 Factors Influencing Natural Disaster Outcomes – Perceived Impact

Variables	**Coefficient**	**Error**
Centralized Decision-Making	0.012	(0.057)
Control of Budget (0= No) (Indicator)		
Control of Budget (1= Yes)	0.009	(0.094)
Red Tape	0.042	(0.069)
Hierarchy	-0.076	(0.044)
Coordination (0=No) (Indicator)		
Coordination (1=Yes, Informal Norm)	-0.017	(0.128)
Coordination (2=Yes, Formal Policy)	-0.010	(0.133)
Fall 2014 Enrollment (0000)	-0.003	(0.036)
Not a Four-Year Institution (Indicator)		
Four-Year Institution	**0.355***	**(0.156)**
Nonprofit Institution (Indicator)		
Public Institution	**0.203***	**(0.101)**
On-Campus Residential Status		
Low (Indicator)		
Medium	-0.181	(0.111)
High	-0.125	(0.133)
Number of Presidential Disaster Declarations	-0.004	(0.006)
Natural Hazard Risk Score	-0.001	(0.002)
Intercept	**1.153*****	**(0.241)**
N	136	
F (26, 109)	*1.420*	
Prob > F	*0.160*	
Adjusted R^2	0.024	

$^{***}p \leq .001$, $^{**}p \leq .01$, $^{*}p \leq .05$, $^{+}p \leq .10$
Two-tailed significance and robust standard errors
Bold indicates significant coefficients
Italics designates that the model not significant

CHAPTER 5: DISCUSSION AND CONCLUSION

This chapter recapitulates the study setup and results, followed by a discussion of results in terms of theory. Then, I consider the implications of this study for practice. A suggested research agenda and concluding remarks round out this section.

5.1 Summary of Study

More than 4,000 colleges and universities exist in the United States (Kapucu & Khosa, 2013). Residential students and the community may depend heavily on the university for food, shelter, and other necessities during a natural disaster. Given this distinctive backdrop to issues that universities and colleges face and the fact that natural disasters are increasing, preparedness for natural disasters is an important consideration. Moreover, the attention devoted to the preparedness function can vary with time since the last disruption (Kettl, 2013).

The purpose of my study is to examine how organizational structural complexity and budgetary flexibility affect the level of natural disaster preparedness performance at institutions of higher learning. I use institutionalism, organization theory, and the New Public Management (NPM) perspective as a framework on which to build the analysis in this study. New Public Management purports to use techniques from the private sector in managing public entities. Following this idea, the theory of managerialism is also introduced to guide my hypotheses.

The first question that this study proposes addresses complexity and coordination. It asks how the degree of natural disaster preparedness of an institution of higher education varies with organizational structural complexity. Investigating this gives us some insight into whether this should matter for managers and will reveal more about how and if the managerial approach is a good fit for IHE structures.

To answer the first question regarding organizational structural complexity, I propose three hypotheses based on previous research and the contingency theory that an organization's structure predicts its effectiveness. The hypotheses for Research Question One are H1, "Comparing U.S. institutions of higher education (IHEs) reveals that those with greater hierarchy do not perform natural disaster preparedness as well as those with less hierarchy."; and H2, "Comparing U.S. IHEs reveals that those with the direct integration exhibit better performance in natural disaster preparedness than those with indirect or no integration."

The second research question addresses budgetary flexibility. It asks, "How does natural disaster preparedness performance in institutions of higher education vary with the centralization of decision-making, red tape, and budgetary flexibility?" To address the question, I pose three hypotheses based on ideas from managerialism, proposed by NPM to increase efficiency and effectiveness. For the main question, I present H3, "Comparing U.S. IHEs reveals that those institutions that afford emergency managers flexibility over their budget exhibit better performance in natural disaster preparedness than those without budgetary flexibility."; H4, "Comparing U.S. IHEs reveals that those institutions with less centralized decision-making exhibit better performance in natural disaster preparedness than those with more centralized decision-making"; and H5, "Comparing

U.S. IHEs reveals that those institutions with less organizational red tape exhibit better performance in natural disaster preparedness than those with more organizational red tape."

The methods used for this study include procedures for data exploration and measurement analysis of the operationalization of the concepts. For this research, I used a correlational, sequential, exploratory mixed-methods design utilizing cross-sectional semistructured interviews. In turn, this informed my survey construction to improve both construct and internal validity. Semistructured interviews can increase the likelihood that a group of people will interpret questions as intended and can reveal additional differences that may need to be included as controls. I performed linear regression and binominal regression where appropriate based, on the dependent variable.

5.2 Discussion of Results and Theoretical Implications

For the question regarding complexity's relationship with the level of natural disaster preparedness performance outputs, there is some evidence of an association between complexity and level of preparedness outputs, shown in Table 30. While hierarchy is not significant, direct integration of coordination is significantly associated with improvement in organizational natural disaster preparedness outputs of training and exercises. It is just outside the statistical significance for external collaboration outputs. These results point in the direction of NPM and the importance of the manager's role in organizational effectiveness, instead of the traditional rigid approach to structuring administration.

Table 30 Summary of Results by Hypothesis – Question One – Outputs

Hypotheses	Outputs – Training & Exercises	Outputs – Internal Awareness	Outputs – External Collaboration	Outputs – Planning
H1: Institutions with more hierarchy have lower levels of natural disaster performance.	N.S.	Model not Significant	**N.S.**	Model not Significant
H2: Institutions with direct integration of coordination have higher levels of natural disaster performance.	Yes	Model not Significant	N.S.	Model not Significant

N.S. – not significant; **N.S. (Bold)** – not as expected; Yes – significant; **Yes (Bold)** – not as expected

For the question regarding complexity's relationship with level of natural disaster preparedness performance outcomes, there is some evidence of an association between complexity and level of preparedness outputs, displayed in Table 31. The model for perceived organizational performance shows that coordination is positively related to preparedness outcomes and that direct coordination exceeds indirect. The count models for the number of days classes were canceled and the campus was closed show a significant relationship between both direct and indirect coordination, leading to managers playing a role in organizational effectiveness for natural disaster preparedness, while hierarchy is not significant. However, all are in the direction opposite of that proposed by contingency theory and NPM with the idea that adaptability through coordination would improve effectiveness. There may be some explanation for this finding, in the form of a mediating variable that requires additional exploration (see "Future Research Agenda" below).

Table 31 Summary of Results by Hypothesis – Question One – Outcomes

Hypotheses	Outcomes – Days Classes Canceled	Outcomes – Days Campus Closed	Outcomes – Perceived Performance	Outcomes – Perceived Impact
H1: Institutions with more hierarchy have lower levels of natural disaster performance.	**N.S.**	**N.S.**	N.S.	Model not Significant
H2: Institutions with direct integration of coordination have higher levels of natural disaster performance.	**Yes**	**Yes**	Yes	Model not Significant

N.S. – not significant; **N.S. (Bold)** – not as expected; Yes – significant; **Yes (Bold)** – not as expected

For the question regarding budgetary flexibility, centralization, and red tape's relationship with level of natural disaster preparedness performance outputs, there is mixed support for these relationships. This indicates some evidence that certain aspects of organizations matter less than the managerial approach would lead one to expect. Budgetary flexibility shows some evidence of a relationship to certain aspects of natural disaster preparedness performance outputs. This is in line with NPM and letting the manager manage, as well as good financial management that allows the manager to make adjustments in resource allocations involving training and exercises, to improve effectiveness. However, budgetary flexibility does not have the expected influence over external collaborations, which require more leadership involvement. This is important because the lack of significance is just outside the determined level of 0.10. Organizational red tape, defined as burdensome rules that negatively affect organizational effectiveness (different from formalization), has an apparent relationship with some natural disaster outputs, such as training and exercises and external collaborations. This shows evidence for the managerial approach over the strictly rule-bound, traditional approach to public administration. If managers are less encumbered by overly burdensome rules, they can react and adapt to situations as they arise. Centralized

decision-making is less important to natural disaster preparedness outputs than theory suggests.

Table 32 Summary of Results by Hypothesis – Question Two – Outputs

Hypotheses	Outputs – Training & Exercises	Outputs – Internal Awareness	Outputs – External Collaboration	Outputs – Planning
H3: Institutions that give emergency managers flexibility over their budget have higher performance in natural disaster preparedness.	Yes	Model not Significant	**N.S.**	Model not Significant
H4: Institutions with less centralized decision-making have higher performance in natural disaster preparedness than those with more centralized decision-making.	N.S.	Model not Significant	**N.S.**	Model not Significant
H5: Institutions with less organizational red tape have higher performance in natural disaster preparedness than those with more organizational red tape.	Yes	Model not Significant	Yes	Model not Significant

N.S. – not significant; **N.S. (Bold)** – not as expected; Yes – significant; **Yes (Bold)** – not as expected

Examining the relationship between outcomes and budgetary flexibility, centralization, and red tape shows some evidence for support of the NPM approach that fosters managerialism, which allows managers more flexibility to adapt to situations that arise from environmental factors exterior to the organization. The outcome models for red tape related to the days classes were canceled and the campus was closed were negatively related to improved performance. In addition, budgetary flexibility for the days classes were canceled was associated with increased levels of performance. According to this testing, centralization has less of a relationship than expected with natural disaster preparedness outcomes.

Table 33 Summary of Results by Hypothesis – Question Two – Outcomes

Hypotheses	Outcomes – Days Classes Canceled	Outcomes – Days Campus Closed	Outcomes – Perceived Performance	Outcomes – Perceived Impact
H3: Institutions that give emergency managers flexibility over their budget have higher performance in natural disaster preparedness.	Yes	N.S.	N.S.	Model not Significant
H4: Institutions with less centralized decision-making have higher performance in natural disaster preparedness than those with more centralized decision-making.	**N.S.**	**N.S.**	N.S.	Model not Significant
H5: Institutions with less organizational red tape have higher performance in natural disaster preparedness than those with more organizational red tape.	Yes	Yes	N.S.	Model not Significant

N.S. – not significant; **N.S. (Bold)** – not as expected; Yes – significant; **Yes (Bold)** – not as expected

5.3 Implications for Practice

This research not only makes theoretical contributions but also has practical applications. This study offers insight into college and university disaster performance management. Emergency management in higher education is a developing area. Policies regarding tasks and integration are still forming. The results that integrating coordination into the hierarchy could be implemented easily into any current structure. A simple policy or line of reporting in a job description could set the tone for coordination of natural disaster preparedness with the institution's leadership.

While salaries are usually the largest expenditure, generally there is enough of a budget for emergency management that discretion over allocation could create improvements. Designing financial-management systems that push responsibility for allocation into the hands of the manager is feasible. Running background checks is already part of the hiring process at most institutions. Making candidates for management positions that would have this responsibility subject to the same hiring procedures that

the organization's financial managers already must satisfy logistically easy and relatively inexpensive.

5.4 Future Research Agenda

Future research will include looking into the questions uncovered by this investigation. A mediating variable may play a role in complexity and natural disaster performance. Potential exploration may include whether the emergency management function is a stand-alone unit or part of another unit that may play a role in organizational effectiveness. Also, an exploration of information availability and networking with area natural-hazard experts could lead to a mediating effect on performance of natural disaster preparedness in an institution of higher learning.

Future inquiries should include exploration of mitigating effects of other organizational structural characteristics, budgetary flexibility, and other characteristics that organizational red tape influences, affecting organizational performance. As suggested by Boyne et al. (2006), research related to other organizational characteristics, such as those found by Pandey and Moynihan (2006), could lead to additional moderating variables for red tape. This line of empirical testing to explore the presence of other factors that reduce red-tape effects would further contribute to the greater effectiveness of NPM than that of traditional approaches to public administration.

The models in Tables 23, 25, and 29 were not significant. Other factors than organizational structural and budgetary flexibility variables predict internal-awareness outputs, planning outputs, and perceived-impact outcomes. These outputs and outcomes may be driven by capacity rather than structure. This is important information to understand and provides a wealth of research opportunities in searching for the answers.

5.5 Conclusion

Studying environmental factors that can strain organizations offers a unique opportunity to explore the structural influence on and the manager's role in organizational performance. It presents an opportunity to test not only the part of contingency theory that argues for structure predicting performance but also the managerial aspect of NPM that contends that giving managers more discretion can lead to improved performance. This study presents various evidence that structure and budgetary flexibility do influence natural disaster preparedness performance. However, not all types of outputs or all measurements of outcomes are predicted significantly by structure and budgetary flexibility. Managerial discretion is related to some increases in performance, but not all. Coordination influences performance more than layers of hierarchy. This provides an argument for NPM as a more effective and efficient way to manage, compared to the traditional approach to public administration. There are important caveats to note. NPM does not consider the political or legal approaches to public administration, nor is it a complete replacement for hierarchy. There can be a need for different types of structures in an organization at the same time, to meet every purpose.

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APPENDIX A: IRB APPROVAL

OFFICE OF RESEARCH COMPLIANCE
9201 University City Boulevard
319 Cameron Hall
Charlotte NC 28223-0001
(704)-687-1871
Web site: http://research.uncc.edu/
Federalwide Assurance (FWA) #00000649

To: JoEllen Pope
Public Policy

From: IRB

Date: 3/31/2017
RE: Notice of Approval of Exemption
Exemption Category: 2.Survey, interview, public observation
Study #: 17-0108

Study Title: University Natural Disaster Preparedness: An Organizational Management Perspective

This submission has been reviewed by the IRB and was determined to meet the Exempt category cited above under 45 CFR 46.101(b).

This determination will expire one year from the date of this letter. It is the Principal Investigator's responsibility to submit for renewal of this determination. You are required to obtain IRB approval for any changes to any aspect of this study before they can be implemented.

Study Description:

The findings of this will benefit university and college administrators in the United States. First, it will give an overall state of how well American universities and colleges are prepared for natural disasters. Second, the study will provide consider whether organizational design affects how well-prepared universities are for natural disasters. With this information, universities and colleges can explore a potential restructuring of business units and adaptive measures to attain the level of preparedness for natural disasters they require.

Investigator's Responsibilities:

It is the investigator's responsibility to promptly inform the committee of any changes in the proposed research, and of any adverse events or unanticipated risks to participants or others. You are required to obtain IRB approval for any changes to any aspect of this study before they can be implemented.

If applicable, your approved consent forms and other documents are available online at http://uncc.myresearchonline.org/irb/index.cfm?event=home.dashboard.irbStudyManagement&irb_id=17-0108.

Data security procedures must follow procedures as approved in the protocol and in accordance with ITS Guidelines for Data Handling and the End User Checklist.

Please be aware that approval may still be required from other relevant authorities or "gatekeepers" (e.g., school principals, facility directors, custodians of records).

CC:
Suzanne Leland, Political Science and Public Administration

APPENDIX B: EMAIL INVITATION FOR INTERVIEW

Subject: Take part in helping higher education prepare for disasters

JoEllen Pope <jvpope@uncc.edu>
Mar 22, 2018, 5:10 PM
to university official

Good Afternoon,

My name is JoEllen Pope. I am a doctoral student writing a dissertation on how universities strive to protect their students, faculty, and staff from harm through planning for natural disasters. As you know, emergency managers are the critical communicators and coordinators when disaster strikes. Having the opinions of experts such as yourself is very valuable to move the field forward.

I know your time is very valuable and I will make the interview as short and convenient as possible. The interviews will be anonymous and will not contain any identifying information about your institution. Instead, the data will be aggregated and reported in a manner to ensure your anonymity but still will convey how important and critical your role is and highlight the best practices for preparedness for others in the profession. I will be happy to provide you a summary of the results once the study is complete.

I would love to schedule a convenient time to discuss your experiences. Please respond to this email and let me know a good day and time in the next week when I can give you a call. I look forward to including your expertise and knowledge in my national research findings of the important work you do every day.

Sincerely,
JoEllen Pope

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JoEllen V. Pope | Ph.D. Candidate in Public Policy UNC Charlotte
Fretwell 285F
9201 University City Blvd. | Charlotte, NC 28223
jvpope@uncc.edu | http://publicpolicy.uncc.edu/people/joellen-pope

APPENDIX C: INFORMED CONSENT FOR INTERVIEW

Public Policy PhD Program

9201 University City Boulevard, Charlotte, NC 28223-0001
t/ 704-687-1363 f/ 704-687-1400 http://publicpolicy.uncc.edu

Informed Consent for

University Natural Disaster Preparedness: An Organizational Management Perspective: Semi-Structured Interview

You are invited to participate in a research study entitled University Natural Disaster Preparedness: An Organizational Management Perspective. This is a research study to assess how organizational design and adaptability are associated with natural disaster preparedness. JoEllen V. Pope, Public Policy PhD Candidate, at University of North Carolina at Charlotte, is conducting this study. The responsible faculty member is Dr. Suzanne M. Leland. You are invited to participate in this study if you are over 18 years of age and in the position primarily responsible for the natural disaster preparedness function of your University.

If you volunteer to participate in this study, you will be asked to participate in an interview that will be audio taped using a digital voice recorder. Interviews will be conducted individually over the phone. Your participation in this project will take approximately 1 hour for one interview. If you decide to participate, you will be one of 8-16 universities in this part of the study. These interviews will be used to design an online survey that will be distributed to other colleges and universities in the United States. These interviews will not be reported on or included in the final data.

There are no known risks to participation in this study. However, there may be risks which are currently unforeseeable. The benefit of participation in this study is the release of anonymous online survey results delivered in report format. This information can be used for strategic planning in organizing a department or business unit responsible for university natural disaster preparedness.

You are a volunteer. The decision to participate in this study is completely up to you. If you decide to be in the study, you may stop at any time. You will not be treated

any differently if you decide not to participate or if you stop once you have started. Any information about your participation, including your identity, will be kept confidential to the extent possible and will only be disclosed with your permission or as required by law. The following steps will be taken to ensure this confidentiality:

- *Audio recordings will be transcribed*
- *Once transcribed, the recordings will be securely destroyed*
- *All data will be stored on two one terabyte external hard drives that will be password protected and secured in a locked cabinet in two separate locations in locked offices*
- *Access to any materials will only be allowed to the primary investigator, responsible faculty member, and if necessary for consultation with other faculty members for their expertise*
- *The interviews will be used to design an online survey and will not be reported on or included in the final data set*
- *Once the online survey is designed, the transcriptions will be securely destroyed*

UNC Charlotte wants to make sure that you are treated in a fair and respectful manner. Contact the University's Research Compliance Office (704-687-1871) if you have any questions about how you are treated as a study participant. If you have any questions about the actual study, please contact JoEllen Pope (704-241-8827, jvpope@uncc.edu) or Dr. Suzanne Leland (704-687-7260, smleland@uncc.edu).

I have read the information in this consent form. I have had the chance to ask questions about this study, and those questions have been answered to my satisfaction. I am at least 18 years of age, and I agree to participate in this research project. I understand that I will receive a copy of this form after it has been signed by me and the Principal Investigator of this research study.

_____ _____

Participant Name (PRINT) DATE

_____ _____

Participant Signature DATE

_____ _____

Investigator Signature DATE

APPENDIX D: SEMI-STRUCTURED INTERVIEW QUESTIONS

Interview Questions

This study will use a modified definition from Presidential Policy Directive 8 that preparedness "refers to the actions taken to plan, organize, equip, train, and exercise to build and sustain the capabilities necessary to prevent, protect against, mitigate the effects of, respond to, and recover" from natural disasters.

1. Are natural disasters (earthquakes, floods, hail, hurricane storm surge, tornadoes, wildfires, etc.) a threat to your institution?
2. Do you think your institution is well prepared (activities that occur before a natural disaster) for a natural disaster? What preparedness activities does your institution participate in?
3. What are your responsibilities regarding natural disaster preparedness for your institution?
4. Does anyone else have responsibilities for natural disaster preparedness at your institution?
5. Whom do you report to day-to-day? Does this change in a natural disaster?
6. Do you have direct access to university decision makers (Chancellor/President/Cabinet) in nonemergency situations?
7. Do you have direct access to university decision makers during times of natural disaster? If yes, how formal is this directive?
8. Looking at an organizational chart, how many levels in the university hierarchical structure are there between you and the decision makers?

9. Do you think the number of hierarchal levels between you and the decision-makers impedes natural disaster preparedness efforts?
10. Within which department does the natural disaster preparedness function reside at your institution? Does it work? If not, where should it reside?
11. How many staff members serve in the unit responsible for natural disaster preparedness? Has this number varied over the last few years? Which direction?
12. Are there budgeted funds allocated to the unit responsible for natural disaster preparedness? Does the unit responsible for natural disaster preparedness have control over its own budget? Has it varied over the last few years? Which direction?
13. In terms of natural disaster preparedness, what are some characteristics or actions of a well-prepared universities?
14. Is there a difference between the way you prepare for natural disaster and for other events such as active shooters or other security threats?
15. Have you ever contracted out or considered contracting out any part of the natural disaster preparedness function for natural disasters? For any other type of hazard?
16. At what point would you reach out for assistance in a natural disaster? Do you have any agreements in place for assistance during natural disasters?
17. Thank you. Is there anything else you would like to add?

APPENDIX E: SURVEY INSTRUMENT

University Preparedness Survey

Q1.1

My name is JoEllen Pope. I am a doctoral student writing a dissertation on how universities strive to protect their students, faculty, and staff from harm through planning for natural disasters. As you know, emergency managers are the critical communicators and coordinators when disaster strikes. I am interested in understanding natural disaster preparedness at institutions of higher education. You will be presented with information relevant to your institution's natural disaster preparedness and asked to answer some questions about it. Please be assured that your responses will be kept completely confidential.

The study should take you around 15 minutes to complete, and the first 50 completed surveys will receive a $5 Target gift card and all completed surveys will be entered in a drawing for a $250 Amazon gift card for your participation. Your participation in this research is voluntary. You have the right to withdraw at any point during the study, for any reason, and without any prejudice. UNC Charlotte wants to make sure that you are treated in a fair and respectful manner. Contact the University's Research Compliance Office (704-687-1871) if you have any questions about how you are treated as a study participant. If you have any questions about the actual study, please contact JoEllen Pope (jvpope@uncc.edu) or Dr. Suzanne Leland (smleland@uncc.edu or 704-687-7260). This research is supported by the Thomas L. Reynolds Graduate Student Research Award and the University of North Carolina at Charlotte.

By clicking the button below, you acknowledge that your participation in the study is voluntary, you are 18 years of age, and that you are aware that you may choose to terminate your participation in the study at any time and for any reason. Also, you will be prompted to answer all questions. You may choose to not answer any question by selecting "Continue Without Answering."

❍ I agree (1)
❍ I do not agree (2)

Q2.1 For this survey, the term "**preparedness**" refers to the actions taken prior to a natural disaster to plan, organize, equip, and train to build and sustain the capabilities necessary to prevent, protect against, mitigate the effects of, respond to, and recover from natural disasters.

The term "**natural disaster**" means any drought, earthquake, flood, hail, hurricane, landslide, severe thunderstorms, severe winter weather, tornado, or wildfire which causes, or which may cause, disruptions to the functioning of a community and/or substantial damage or injury to persons. Natural disasters exclude man-made emergencies like incidents of violence.

The term "**emergency management"** is the managerial function charged with creating the framework within which communities reduce vulnerability to hazards and cope with disasters of all types.

Q2.2 Do you have primary responsibility for natural disaster preparedness at your institution?

- ❍ Yes (1)
- ❍ No (2)

Q2.3 Does anyone share day-to-day responsibility for natural disaster preparedness at your institution?

- ❍ Yes (1)
- ❍ No (2)

Q2.4 What is your position title?

_____

Q2.5 How long have you worked at your institution in your current position? Please provide the number of years.

_____

Q2.6
Please indicate the number of institutions/campuses your office covers in regards to natural disaster preparedness.

	Number (1)
Institutions (system-wide) (1)	
Campuses (satellites) (2)	

Q3.1 How much of a threat is each of the following natural disasters to your institution? Please assess the level of threat.

	No Risk (1)	Very low risk (2)	Low risk (3)	Moderate risk (4)	High risk (5)	Very high risk (6)
Earthquakes (1)	❍	❍	❍	❍	❍	❍
Floods (2)	❍	❍	❍	❍	❍	❍
Hurricanes (3)	❍	❍	❍	❍	❍	❍
Hail (4)	❍	❍	❍	❍	❍	❍
Tornadoes (5)	❍	❍	❍	❍	❍	❍
Wildfires (6)	❍	❍	❍	❍	❍	❍
Severe Thunderstorms (9)	❍	❍	❍	❍	❍	❍
Severe Winter Weather (10)	❍	❍	❍	❍	❍	❍
Landslides (7)	❍	❍	❍	❍	❍	❍
Drought (13)	❍	❍	❍	❍	❍	❍
Other Natural Hazard (12)	❍	❍	❍	❍	❍	❍

Q3.2 On the scale below, how prepared is your institution for the following?

	Not prepared at all (1)	Slightly prepared (2)	Moderately prepared (3)	Very prepared (4)	Extremely prepared (5)
Mitigation for a natural disaster (17)	❍	❍	❍	❍	❍
Planning for a natural disaster (16)	❍	❍	❍	❍	❍
Response to a natural disaster (14)	❍	❍	❍	❍	❍
Recovery from a natural disaster (15)	❍	❍	❍	❍	❍
Overall natural disaster preparedness (18)	❍	❍	❍	❍	❍

Q4.1 At your institution, which department or unit houses the emergency management function? (Check all that apply.)

- ☐ Stand-alone Emergency Management or Business Continuity (1)
- ☐ Risk Management (2)
- ☐ Public Safety (3)
- ☐ Police (4)
- ☐ Environmental Health & Safety (5)
- ☐ Business Office (6)
- ☐ Facilities or Operations (7)
- ☐ Academic Affairs or Provost (8)
- ☐ Finance and Administration (9)
- ☐ Office of Student Life or Affairs (10)
- ☐ Administration (Policy-making Group, i.e. Chancellor and cabinet or President and highest vice presidents) (11)
- ☐ Other (12) _____

Q4.2 At your institution, which department or unit houses the natural disaster preparedness function? (Check all that apply.)

- ☐ Stand-alone Emergency Management or Business Continuity (1)
- ☐ Risk Management (2)
- ☐ Public Safety (3)
- ☐ Police (4)
- ☐ Environmental Health & Safety (5)
- ☐ Business Office (6)
- ☐ Facilities or Operations (7)
- ☐ Academic Affairs or Provost (8)
- ☐ Finance and Administration (9)
- ☐ Office of Student Life or Affairs (10)
- ☐ Administration (Policy-making Group, i.e. Chancellor and cabinet or President and highest vice presidents) (11)
- ☐ Other (12) _____

Q4.3 Have the following functions ever moved within the organizational structure of your institution?

	Yes (1)	No (2)	Don't Know (3)
Emergency Management Function (1)	❍	❍	❍
Natural Disaster Preparedness Function (2)	❍	❍	❍

Q4.4 When have the following functions moved within the organizational structure of your institution?

	In process of moving (1)	Moved in the last 5 years (2)	Moved in the last 10 years (3)
Emergency Management Function (1)	❍	❍	❍
Natural Disaster Preparedness Function (2)	❍	❍	❍

Q4.5 If your institution's leadership is assigned level 1, what level in the organizational hierarchy (organizational chart) is the person primarily responsible for natural disaster preparedness assigned? In this case, leadership means policy-making groups such as chancellor and cabinet or president and highest ranking vice presidents.

❍ 1 (1)
❍ 2 (2)
❍ 3 (3)
❍ 4 (4)
❍ 5 (5)
❍ 6 (6)
❍ 7 or more (7)

Q4.6 Please provide any supplemental explanation about the organizational hierarchy.

_____
_____
_____

Q4.7 Do you have direct access to your institution's leadership during the following times? In this case, leadership means policy-making groups such as chancellor and cabinet or president and highest ranking vice presidents.

	Yes (1)	No (2)
Non-emergency situations (4)	❍	❍
Natural disaster situations (5)	❍	❍

Q4.8 Thinking about your direct access to your institution's leadership during the following times, how formalized is the access? In this case, leadership means policy-making groups such as chancellor and cabinet or president and highest ranking vice presidents.

	Formal, as specified by policy (1)	Informal, as a norm not specified by policy (2)
Non-emergency situations (4)	❍	❍
Natural disaster situations (5)	❍	❍

Q4.9 Please provide any supplemental explanation about your direct access to your institution's leadership.

_____

_____

Q4.10 Please indicate your level of agreement or disagreement with each of the following statements about your institution's leadership. In this case, leadership means policy-making groups such as chancellor and cabinet or president and highest ranking vice presidents.

My institution's leadership is committed to its emergency management program (1)

My institution's leadership is committed to natural disaster preparedness (2)

- ❍ Strongly Agree (1)
- ❍ Agree (2)
- ❍ Somewhat agree (3)
- ❍ Neither agree nor disagree (4)
- ❍ Somewhat disagree (5)
- ❍ Disagree (6)
- ❍ Strongly disagree (7)

Q4.11 Please indicate your level of agreement or disagreement with each of the following statements about your institution as a whole. In this case, leadership means policy-making groups such as chancellor and cabinet or president and highest ranking vice presidents.

Even small matters have to be referred to someone higher up for a final answer. (Hall 1963; Hage, & Aiken, 1967)

- ❍ Strongly Agree (1)
- ❍ Agree (2)
- ❍ Somewhat agree (3)
- ❍ Neither agree nor disagree (4)
- ❍ Somewhat disagree (5)
- ❍ Disagree (6)
- ❍ Strongly disagree (7)

Q4.12 There can be little action taken here until leadership approves a decision. (Hall 1963; Hage, & Aiken, 1967)

- ❍ Strongly Agree (1)
- ❍ Agree (2)
- ❍ Somewhat agree (3)
- ❍ Neither agree nor disagree (4)
- ❍ Somewhat disagree (5)
- ❍ Disagree (6)
- ❍ Strongly disagree (7)

Q4.13 The leadership exerts strong control over this institution. (Hage, & Aiken, 1967)

- ❍ Strongly Agree (1)
- ❍ Agree (2)
- ❍ Somewhat agree (3)
- ❍ Neither agree nor disagree (4)
- ❍ Somewhat disagree (5)
- ❍ Disagree (6)
- ❍ Strongly disagree (7)

Q4.14 Please indicate your level of agreement or disagreement with each of the following statements about your institution as a whole. In this case, leadership means policy-making groups such as chancellor and cabinet or president and highest ranking vice presidents.
People at my institution do a good job anticipating problems. (Angle and Perry, 1981)

- ❍ Strongly agree (1)
- ❍ Agree (2)
- ❍ Somewhat agree (3)
- ❍ Neither agree nor disagree (4)
- ❍ Somewhat disagree (5)
- ❍ Disagree (6)
- ❍ Strongly disagree (7)

Q4.15 People at my institution do a good job of keeping up with changes in new equipment and new ways of doing things. (Angle and Perry, 1981)

- ❍ Strongly agree (1)
- ❍ Agree (2)
- ❍ Somewhat agree (3)
- ❍ Neither agree nor disagree (4)
- ❍ Somewhat disagree (5)
- ❍ Disagree (6)
- ❍ Strongly disagree (7)

Q4.16 When changes are made in routines and equipment, people adjust to these changes quickly. (Angle and Perry, 1981)

- ❍ Strongly agree (1)
- ❍ Agree (2)
- ❍ Somewhat agree (3)
- ❍ Neither agree nor disagree (4)
- ❍ Somewhat disagree (5)
- ❍ Disagree (6)
- ❍ Strongly disagree (7)

Q4.17 People at my institution do a good job coping with emergency situations brought on by accidents, equipment, labor problems, or other factors that might cause temporary work overload. (Angle and Perry, 1981)

- ❍ Strongly agree (1)
- ❍ Agree (2)
- ❍ Somewhat agree (3)
- ❍ Neither agree nor disagree (4)
- ❍ Somewhat disagree (5)
- ❍ Disagree (6)
- ❍ Strongly disagree (7)

Q4.18 Please indicate your level of agreement or disagreement with each of the following statements about your institution as a whole. In this case, leadership means policy-making groups such as chancellor and cabinet or president and highest ranking vice-presidents. All in all, I have very little influence over the institutional decisions that affect my department in important ways. (Mohr 1977)

- ❍ Strongly agree (1)
- ❍ Agree (2)
- ❍ Somewhat agree (3)
- ❍ Neither agree nor disagree (4)
- ❍ Somewhat disagree (5)
- ❍ Disagree (6)
- ❍ Strongly disagree (7)

Q4.19 If my department had a suggestion for improvement, it would be difficult for me to get a real hearing on it from my institution's leadership. (Mohr 1977)

- ❍ Strongly agree (1)
- ❍ Agree (2)
- ❍ Somewhat agree (3)
- ❍ Neither agree nor disagree (4)
- ❍ Somewhat disagree (5)
- ❍ Disagree (6)
- ❍ Strongly disagree (7)

Q4.20 Decision making is delegated to the lowest possible level of authority. (Hurley and Hult 1998)

- ❍ Strongly agree (1)
- ❍ Agree (2)
- ❍ Somewhat agree (3)
- ❍ Neither agree nor disagree (4)
- ❍ Somewhat disagree (5)
- ❍ Disagree (6)
- ❍ Strongly disagree (7)

Q4.21 Individuals involved in implementing decisions have a say in making the decisions. (Hurley and Hult 1998)

- ❍ Strongly agree (1)
- ❍ Agree (2)
- ❍ Somewhat agree (3)
- ❍ Neither agree nor disagree (4)
- ❍ Somewhat disagree (5)
- ❍ Disagree (6)
- ❍ Strongly disagree (7)

Q4.22 Based on the rating scale below, please rate the following statement:

If red tape is defined as burdensome administrative rules and procedures that have negative effects on the institution's effectiveness, how would you assess the level of red tape at your institution? (Pandey & Scott, 2002)

	A great deal (0)	A lot (1)	A moderate amount (2)	A little (3)	None at all (4)
Level of Red Tape (1)	❍	❍	❍	❍	❍

Q5.1 Please give the percentage of your time spent on the following functions.

Emergency management function (1)	▼ Zero (1) ... Above 90% (8)
Natural disaster preparedness function (2)	▼ Zero (1) ... Above 90% (8)

Q5.2 How many dedicated full-time employees does your institution employ in the following functions?

	Number FTEs (1)
Emergency management function (1)	
Natural disaster preparedness function (2)	

Q5.3 What is the approximate total budget including salaries and operating for the following functions for the previous fiscal year end?

Emergency management function (1)	▼ $0 (none) (1) ... $500,000 or greater (34)
Natural disaster management function (2)	▼ $0 (none) (1) ... $500,000 or greater (34)

Q5.4 Do you control the budgeted funds for the following functions?

	Yes (1)	No (2)
Emergency management (1)	❍	❍
Natural disaster preparedness (2)	❍	❍

Q5.5 How much has the budget for the following changed over the last three years?

	Increased greatly (1)	Increased slightly (2)	No change (3)	Decreased slightly (4)	Decreased greatly (5)
Emergency management function (1)	❍	❍	❍	❍	❍
Natural disaster preparedness function (2)	❍	❍	❍	❍	❍

Q5.6 Does your institution have contingency funds to supplement operating funds available in the event of a natural disaster?

❍ Yes (1)
❍ No (2)
❍ In process of setting up (3)

Q5.7 Please explain how the contingency fund works.

_____
_____
_____
_____
_____

Q5.8 What modes of communication does your institution have available to deliver information about natural disasters?

	Yes (1)	No (2)
Institutional email (1)	❍	❍
Text messaging (2)	❍	❍
Social media i.e. Facebook (3)	❍	❍
Institutional website (6)	❍	❍
Emergency alert software i.e. Alertus (7)	❍	❍
Emergency sirens (9)	❍	❍
Apps i.e. LiveSafe (8)	❍	❍
Other (5)	❍	❍

Q5.9 Have you ever contracted out any part of the natural disaster preparedness function?

	Yes (1)	No (2)	Considered it (3)
Training (1)	❍	❍	❍
Exercises (2)	❍	❍	❍
Planning (3)	❍	❍	❍
Other (5)	❍	❍	❍

Q6.1 During the past three years, how many different times has a representative of your organization participated in the following?

	0 (1)	1 to 3 (2)	4 to 6 (3)	7 to 9 (4)	10 or more (5)
Training session related to emergency management (2)	❍	❍	❍	❍	❍
Training session related to natural disaster preparedness (3)	❍	❍	❍	❍	❍
Simulated emergency management exercises (4)	❍	❍	❍	❍	❍
Simulated natural disaster exercises (5)	❍	❍	❍	❍	❍

Q6.2 During the coming year, how often will a representative of your organization participate in the following?

	0 (1)	1 (2)	2 (3)	3 (4)	4 or more (5)
Training session related to emergency management (2)	❍	❍	❍	❍	❍
Training session related to natural disaster preparedness (3)	❍	❍	❍	❍	❍
Simulated emergency management exercises (4)	❍	❍	❍	❍	❍
Simulated natural disaster exercises (5)	❍	❍	❍	❍	❍

Q6.3 Regarding your institution's emergency management plans that include natural disaster preparedness, which of the following plans does your institution have?

	No plan (1)	Does not address natural disasters (2)	Currently drafting initial plan (3)	Have plan (4)
Strategic Plan (1)	❍	❍	❍	❍
Threat and Hazard Identification and Risk Assessment (8)	❍	❍	❍	❍
Emergency Operations/Response/Action Plan (EOP/ERP/EAP) (2)	❍	❍	❍	❍
Business Continuity Plan(s) (3)	❍	❍	❍	❍
Continuity of Operations Plan (4)	❍	❍	❍	❍
Natural Hazard Mitigation Plan (5)	❍	❍	❍	❍
Recovery Plan (6)	❍	❍	❍	❍
Training and Exercise Plan (7)	❍	❍	❍	❍
Crisis Communication Plan (9)	❍	❍	❍	❍
Storm Ready Hazardous Weather Plan (10)	❍	❍	❍	❍
Campus Evacuation Plan (11)	❍	❍	❍	❍
Other Plan (12)	❍	❍	❍	❍

Q6.4 How long has it been since the following plans have been reviewed and updated?

	Less than 12 Months (1)	12 -36 months (2)	37 -60 months (3)	More than 60 months (4)
Strategic Plan (1)	❍	❍	❍	❍
Threat and Hazard Identification and Risk Assessment (8)	❍	❍	❍	❍
Emergency Operations/Response/Action Plan (EOP/ERP/EAP) (2)	❍	❍	❍	❍
Business Continuity Plan(s) (3)	❍	❍	❍	❍
Continuity of Operations Plan (4)	❍	❍	❍	❍
Natural Hazard Mitigation Plan (5)	❍	❍	❍	❍
Recovery Plan (6)	❍	❍	❍	❍
Training and Exercise Plan (7)	❍	❍	❍	❍
Crisis Communication Plan (9)	❍	❍	❍	❍
Storm Ready Hazardous Weather Plan (10)	❍	❍	❍	❍
Campus Evacuation Plan (11)	❍	❍	❍	❍
Other Plan (12)	❍	❍	❍	❍

Q6.5 During the past three years, how many times has your institution activated its emergency operations center (EOC)?

	No EOC facilities (1)	0 (2)	1 (3)	2 (4)	3 (5)	4 (6)	5 (7)	6 or more (8)
Any type of event (1)	❍	❍	❍	❍	❍	❍	❍	❍
Natural disaster (2)	❍	❍	❍	❍	❍	❍	❍	❍

Q6.6 During the past three years, how many natural disaster preparedness awareness events has your institution conducted involving the following?

	No public awareness program (1)	0 (2)	1-2 (3)	3-4 (4)	5-6 (5)	7-8 (6)	9 or more (7)
Students (1)	❍	❍	❍	❍	❍	❍	❍
Faculty (2)	❍	❍	❍	❍	❍	❍	❍
Staff (3)	❍	❍	❍	❍	❍	❍	❍

Q6.7 Do you have any Memorandums of Understanding (MoUs) or Mutual aid agreements (MAAs) with the following?

	Yes (1)	No (2)	Currently drafting document (3)
State (1)	❍	❍	❍
County (2)	❍	❍	❍
Institutions within state (3)	❍	❍	❍
Institutions outside of state (4)	❍	❍	❍
National Intercollegiate Mutual Aid Agreement (NIMAA) (5)	❍	❍	❍
Other (6)	❍	❍	❍

Q7.1 Which of the following best describes your highest educational level?

▼ Less than high school (1) ... Other (8)

Q7.2 Are you a member of an emergency management professional organization?

❍ Yes (1)
❍ Used to be (2)
❍ No (3)
❍ Plan to join (4)

Q7.3 Which emergency management association(s) do you belong to? (Check all that apply.)

- ☐ International Association of Emergency Managers (IAEM) (1)
- ☐ Your state's emergency management association (2)
- ☐ The Disaster Preparedness and Emergency Response Association, International (DERA) (3)
- ☐ National Emergency Management Association (NEMA) (4)
- ☐ Other (5) _____
- ☐ Other (6) _____

Q7.4 How often do you personally attend the following practitioner conferences?

	Always (1)	Most of the time (2)	About half the time (3)	Sometimes (4)	Never (5)
State Emergency Management Conference (1)	❍	❍	❍	❍	❍
Best Practices in Higher Education Emergency Management Conference (2)	❍	❍	❍	❍	❍
FEMA Annual Emergency Management Higher Education Symposium (4)	❍	❍	❍	❍	❍
Other (3)	❍	❍	❍	❍	❍
Other (6)	❍	❍	❍	❍	❍

Q8.1 During the last three years, about how many times have the following natural disaster events occurred at your institution?

	Never (1)	Once (2)	Two to three times (3)	Four to five times (4)	More than five times (5)
Drought (15)	❍	❍	❍	❍	❍
Earthquakes (1)	❍	❍	❍	❍	❍
Floods (3)	❍	❍	❍	❍	❍
Hurricanes (4)	❍	❍	❍	❍	❍
Tornadoes (5)	❍	❍	❍	❍	❍
Hail (6)	❍	❍	❍	❍	❍
Wildfires (7)	❍	❍	❍	❍	❍
Severe Thunderstorms (8)	❍	❍	❍	❍	❍
Severe Winter Weather (9)	❍	❍	❍	❍	❍
Landslides (13)	❍	❍	❍	❍	❍
Other Natural Hazard (11)	❍	❍	❍	❍	❍

Q8.2 Thinking about the natural disaster events that have happened at your institution in the previous three years, please assess the level of adverse impact for the following.

	None (1)	Minor (2)	Moderate (3)	Major (4)	Catastrophic (5)
Drought (15)	❍	❍	❍	❍	❍
Earthquakes (1)	❍	❍	❍	❍	❍
Floods (3)	❍	❍	❍	❍	❍
Hurricanes (4)	❍	❍	❍	❍	❍
Tornadoes (5)	❍	❍	❍	❍	❍
Hail (6)	❍	❍	❍	❍	❍
Wildfires (7)	❍	❍	❍	❍	❍
Severe Thunderstorms (8)	❍	❍	❍	❍	❍
Severe Winter Weather (9)	❍	❍	❍	❍	❍
Landslides (13)	❍	❍	❍	❍	❍
Other Natural Hazard (11)	❍	❍	❍	❍	❍

Q8.3 During the last three years, which of the following actions has your agency undertaken as a result of natural disaster events? (Choose all that apply.)

- ☐ Canceled classes (1)
- ☐ Closed campus (2)
- ☐ Closed buildings (3)
- ☐ Delayed start of classes (4)
- ☐ Moved to an online class format (5)
- ☐ Partnered with another institution to resume classes (6)
- ☐ Other (7) _____

Q8.4 Thinking the last three years, approximately how many days was your institution in the following situations due to a natural disaster?

	Number of days (1)
Canceled classes (1)	
Closed campus (2)	
Closed buildings (3)	
Delayed start of classes (7)	
Moved to an online class format (4)	
Partnered with another institution to resume classes (5)	
Other (6)	

Q8.5 Thinking of your most adverse natural disaster in the last three years, please assess how prepared your institution was for dealing with the following?

	Not effective at all (1)	Slightly effective (2)	Moderately effective (3)	Very effective (4)	Extremely effective (5)
Mitigating for the natural disaster (16)	❍	❍	❍	❍	❍
Planning for the natural disaster (14)	❍	❍	❍	❍	❍
Response to the natural disaster (11)	❍	❍	❍	❍	❍
Recovery from the natural disaster (12)	❍	❍	❍	❍	❍
Activation of the emergency operations center (EOC) (13)	❍	❍	❍	❍	❍

Q8.6 Did your institution reach out for mutual aid from the following entities?

	Yes (1)	No (2)
County (1)	❍	❍
State (2)	❍	❍
Other higher education institution (3)	❍	❍
Other (4)	❍	❍

Q9.1 Is there anything you would like to add regarding any of the topics covered in this questionnaire?

_____
_____
_____
_____
_____

Q10.1 Please enter the name of your institution. (Your answer to this question will allow critical demographic data about your institution to be matched with your answers and will improve the research study. Your responses are confidential. Data will be examined for trends, and only aggregated findings will be reported. You will not be identified in the results.)

_____

Q10.2
Earlier you indicated that you do not have primary responsibility for natural disaster preparedness at your institution. Who is primarily responsible for natural disaster preparedness at your institution? (Please include name(s) and email address(es). If you do not have three contacts to enter, please enter "NA" in the blank fields.)

- ❍ Name (15) _____
- ❍ Email address (16) _____
- ❍ Name (17) _____
- ❍ Email address (18) _____
- ❍ Name (22) _____
- ❍ Email address (23) _____

Q10.3 What is your current salary level?

▼ Less than $25,000 (1) ... More than $150,000 (7)

Q10.4
Earlier you indicated that responsibility for natural disaster preparedness is shared at your institution. Who shares responsible for natural disaster preparedness with you at your institution? (Please include name(s) and email address(es). If you do not have three contacts to enter, please enter "NA" in the blank fields.)

- ❍ Name (15) _____
- ❍ Email address (16) _____
- ❍ Name (17) _____
- ❍ Email address (18) _____
- ❍ Name (22) _____
- ❍ Email address (23) _____

Q11.1 If you are one of the first fifty completed surveys, do you want a $5 Target gift card?

- ❍ Yes (1)
- ❍ No (2)

Q11.2 To receive your $5 Target gift card, please enter your information below.

- ❍ Name (1) _____
- ❍ Email address (2) _____

Q11.3 Would you like to be entered into a drawing for a $250 Amazon gift card?

- ❍ Yes (1)
- ❍ No (2)

Q11.4 For your chance to win the $250 Amazon gift card, please enter your information below.

- ❍ Name (1) _____
- ❍ Email address (2) _____

Q11.5 Would you like a copy of the report produced from this information?

- ❍ Yes (1)
- ❍ No (2)

Q11.6 To receive a copy of the report, please enter your information below.

- ❍ Name (1) _____
- ❍ Email address (2) _____

APPENDIX F: QUALTRICS ONLINE SURVEY INVITATION

Subject: Take part in helping higher education prepare for natural disasters

Dear [Potential Representative],

I am reaching out to you today to ask for help with an exciting study that will benefit the national higher education emergency management community.

My name is JoEllen Pope. I am a doctoral student writing a dissertation on how universities strive to protect their students, faculty, and staff from harm through planning for natural disasters. As you know, emergency managers are the critical communicators and coordinators when disaster strikes. I am interested in understanding natural disaster preparedness at institutions of higher education. You will be presented with information relevant to your institution's natural disaster preparedness and asked to answer some questions about it. Please be assured that your responses will be kept completely confidential.

The study should take you around 15 minutes to complete, and the first 50 completed surveys will receive a $5 Target gift card and all completed surveys will be entered in a drawing for a $250 Amazon gift card for your participation. Your participation in this research is voluntary. You have the right to withdraw at any point during the study, for any reason, and without any prejudice. UNC Charlotte wants to make sure that you are treated in a fair and respectful manner. Contact the University's Research Compliance Office (704-687-1871) if you have any questions about how you are treated as a study participant. If you have any questions about the actual study, please contact JoEllen Pope (jvpope@uncc.edu) or Dr. Suzanne Leland (smleland@uncc.edu or 704-687-7260). This research is supported by the Thomas L. Reynolds Graduate Student Research Award and the University of North Carolina at Charlotte.

By clicking the button below, you acknowledge that your participation in the study is voluntary, you are 18 years of age, and that you are aware that you may choose to terminate your participation in the study at any time and for any reason. Also, you will be prompted to answer all questions. You may choose to not answer any question by selecting "Continue Without Answering."

❍ Yes (1)
❍ No (2)

Any help you could give would be appreciated! Thank you,
JoEllen
--
JoEllen V. Pope, MPA, CPA, AEM Ph.D. Candidate in Public Policy UNC Charlotte
9201 University City Blvd. | Charlotte, NC 28223 jvpope@uncc.edu | Candidate website
Trouble with the survey link above?

Please click this link to begin the survey:
www.emonlinesurvey.com

Follow the link to opt out of future emails:
Click here to unsubscribe

APPENDIX G: DRU LISTSERV ONLINE SURVEY INVITATION

Subject: Take part in helping higher education prepare for natural disasters

Dear Colleagues,

I am reaching out to you today to ask for help with an exciting study that will benefit the national higher education emergency management community.

My name is JoEllen Pope. I am a doctoral candidate writing a dissertation on how universities strive to protect their students, faculty, and staff from harm through planning for natural disasters. As you know, emergency managers are the critical communicators and coordinators when disaster strikes. Having the opinions of experts such as yourself is very valuable to move the field forward.

To improve our understanding of university natural disaster preparedness and organizational behavior, the national university and college natural disaster preparedness survey will collect information about how institutions adapt their internal organization to external threats such as natural disasters. Your participation in this effort is crucial. I hope to hear from the entire community of higher education professionals who are involved with natural disaster preparedness at their institutions.

The data will be aggregated and reported in a manner to ensure your confidentiality but still will convey how important and critical your role is and highlight the best practices for preparedness for others in the profession. I will be happy to provide a summary of the results once the study is complete.

The survey should take around 15 minutes to complete. Also, as an incentive, the first 50 completed surveys will receive a $5 Target gift card and all completed surveys will be entered in a drawing to receive a $250 Amazon gift card. I sincerely hope you click the survey link below and forward the link to colleagues on your campus and other institutions that manage natural disaster preparedness at your institution. Multiple responses from individual institutions are encouraged.

Please click this link to begin the survey:
www.emonlinesurvey.com

This research is supported by the Thomas L. Reynolds Graduate Student Research Award and the University of North Carolina at Charlotte. If you have any questions about the actual study, please contact JoEllen Pope (jvpope@uncc.edu) or Dr. Suzanne Leland (smleland@uncc.edu).

Any help you could give would be appreciated! Thank you,
JoEllen
JoEllen V. Pope, MPA, CPA, AEM Ph.D. Candidate in Public Policy UNC Charlotte
9201 University City Blvd. | Charlotte, NC 28223 jvpope@uncc.edu | Candidate website

APPENDIX H: EMAIL REQUEST TO SEND OUT SURVEY INVITATION

Subject: Take part in helping higher education prepare for natural disasters

Good morning!

I am a doctoral student at UNC Charlotte conducting an exciting survey about natural disaster preparedness at higher education institutions. I have attached a synopsis of my dissertation to describe my research. Would you send my survey out to your state emergency manager association membership? If you would consider doing this, that would be great! The text and link to send out are listed below. Thank you for any distribution help that you can provide.

Dear Colleagues,

I am reaching out to you today to ask for help with an exciting study that will benefit the national higher education emergency management community.

My name is JoEllen Pope. I am a doctoral candidate writing a dissertation on how universities strive to protect their students, faculty, and staff from harm through planning for natural disasters. As you know, emergency managers are the critical communicators and coordinators when disaster strikes. Having the opinions of experts such as yourself is very valuable to move the field forward.

To improve our understanding of university natural disaster preparedness and organizational behavior, the national university and college natural disaster preparedness survey will collect information about how institutions adapt their internal organization to external threats such as natural disasters. Your participation in this effort is crucial. I hope to hear from the entire community of higher education professionals who are involved with natural disaster preparedness at their institutions.

The data will be aggregated and reported in a manner to ensure your confidentiality but still will convey how important and critical your role is and highlight the best practices for preparedness for others in the profession. I will be happy to provide a summary of the results once the study is complete.

The survey should take around 15 minutes to complete. Also, as an incentive, the first 50 completed surveys will receive a $5 Target gift card and all completed surveys will be entered in a drawing to receive a $250 Amazon gift card. I sincerely hope you click the survey link below and forward the link to colleagues on your campus and other institutions that manage natural disaster preparedness at your institution. Multiple responses from individual institutions are encouraged.

Please click this link to begin the survey:
www.emonlinesurvey.com

This research is supported by the Thomas L. Reynolds Graduate Student Research Award and the University of North Carolina at Charlotte. If you have any questions about the actual study, please contact JoEllen Pope (jvpope@uncc.edu) or Dr. Suzanne Leland (smleland@uncc.edu).

Any help you could give would be appreciated! Thank you,
JoEllen
--
JoEllen V. Pope | Ph.D. Candidate in Public Policy UNC Charlotte Fretwell 285F
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APPENDIX I: MODEL DIAGNOSTICS

Models in Tables 23, 25, and 29 were not significant. These models had nonsignificant F statistics. No further diagnostics were conducted on these models.

For the model in Table 22, I performed diagnostics on the model to test the assumptions of and check for multicollinearity in the linear regression. For the issue of collinearity, I used Stata 14 to run centered variance inflation factors (VIFs) for the independent variables in the model. None of the factors were over 10, and the average for the model was 1.60 (Baum, 2006). Multicollinearity did not appear to be a concern for Model One. I ran tests for linearity, normality of the residuals, homoscedasticity, and model specification. Measurement of predictors was addressed in Chapter 3 (Methodology) and there are no independence violations of time, as the data are cross-sectional.

I tested for the normality of the residuals using the Predict command in Stata 14 to predict the residuals, and I tested visually graphing a standardized normal probability plot (Chambers, 1983) and statistically using skewness and kurtosis tests of normality (Gould, 1991). All tests yielded evidence that the residuals were normally distributed. Heteroscedasticity was checked statistically using the Breusch-Pagan (1979) and Cook-Weisberg (1983) tests for heteroscedasticity and White's (1980) test for homoscedasticity against unrestricted forms of heteroscedasticity; then, visually graphed residuals against the fitted values (Baum, 2006). None of the tests displayed signs of heteroscedasticity. I checked for nonlinearity by plotting a two-way scatter graph between the residuals and each predictor. None of the graphs led me to believe that there was a nonlinear relationship. To check for misspecification of Model One (shown in Table 22), I

performed a link test for model specification (Pregibon, 1979) and the Ramsey (1969) regression specification-error test (RESET) for omitted variables. Neither test indicated the presence of a model misspecification.

For the model in Table 24, I ran VIFs to look for multicollinearity and found no indication of an issue. I ran tests for linearity, normality of the residuals, homoscedasticity, and model specification. I tested for the normality of the residuals visually and statistically. All showed signs that the residuals were normally distributed. Heteroscedasticity was checked statistically and visually, which showed signs of heteroscedasticity. I checked for nonlinearity visually, and nonlinearity did not appear to be a problem. Also, I checked for misspecification. Tests did not indicate a misspecification of this model.

For the model in Table 26, I tested negative binomial regression assumptions of a dependent variable measured as a count, linearity in model parameters, independence of individual observations, and overdispersion. The dependent variable was measured as a count of the number of days that classes were canceled. The independence of observations related to time was not an issue, as the data were cross-sectional. For the potential independence violation of space, regional effects were controlled in the model. Linearity was analyzed visually, with no issues found. The dependent variable was overdispersed, as statistically tested by the likelihood-ratio test of alpha equal to zero, which was significant. This means I rejected the null hypothesis that the mean is equal to the variance. Robust standard errors were used to control for any undetected assumption violations, as suggested by Cameron and Trivedi (2009).

For the model in Table 27, the assumptions for negative binomial regression were tested. The dependent variable was measured as a count variable and was overdispersed since the statistical test was significant. I analyzed linearity in the parameters and found no issues. Robust standard errors were used to control for any undetected assumption violations, as suggested by Cameron and Trivedi (2009).

For the model in Table 28, the variance inflation factor showed no indication of multicollinearity. I tested for the normality of the residuals visually and statistically and found no sign that the residuals were not normally distributed. No indications of heteroscedasticity were found and there appeared to be a linear relationship. Misspecification tests revealed no issue in this model.

Based on the diagnostics found in the tests, linear regression was used with robust standard errors. Robust standard errors do not adjust for misspecified models (King & Roberts, 2015). In addition, the bigger the difference between standard robust errors and classical errors, the more likely the model is misspecified (King & Roberts, 2015) The robust standard errors are similar to the classical standard errors in these model results, suggesting that the models are not misspecified. However, there was heteroscedasticity found in some models, so robust standard errors were used in all models.