

## Exploring the Relationship between Hazard Adjustments and Risk Managers in Organizations

Abdul-Akeem Sadiq, PhD (Corresponding Author)  
School of Public and Environmental Affairs  
Indiana University-Purdue University Indianapolis  
801 West Michigan Street, Indianapolis, IN 46202, USA  
Phone: (317) 278-1013  
Fax: (317) 274-7860  
Email: [asadiq@iupui.edu](mailto:asadiq@iupui.edu)

John D. Graham, PhD  
School of Public and Environmental Affairs  
Indiana University, USA

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## **ABSTRACT**

There is little empirical evidence on the relationship between organizational risk managers and the adoption of hazard adjustments (measures taken to reduce risks from extreme events). Similarly, the risk perception literature is mixed on the relationship between risk perception and the adoption of hazard adjustments in organizations. This study empirically addresses these two gaps using data collected from 227 public, private, and non-profit organizations in the Memphis/Shelby County area, Tennessee in 2006. This study finds a significant positive relationship between risk managers and the adoption of hazard adjustments. The results also indicate that organizational risk perception has a small positive influence on the adoption of hazard adjustments.

**Keywords:** Organizational risk perception; risk manager; mitigation and preparedness measures; hazard adjustments; disasters

## **Introduction**

The losses from global disasters continue to increase each year (Guha-Sapir et al., 2012; Munich Reinsurance Group, 2008). In light of those increases, there is a pressing need to study the ways organizations not only perceive the threat of natural and technological disasters, but also how they manage the consequences of such events. Organizations have relatively more control over technological risks like structural fires and chemical spills compared to natural disaster risks such as hurricanes and tornadoes. Obviously, organizations cannot prevent natural disasters from occurring, but they can mitigate and prepare for the potential consequences (Sadiq, 2009; 2010). ‘Hazard mitigation consists of practices that are implemented before impact and provide *passive* protection at the time impact occurs. By contrast, emergency preparedness practices involve the development of plans and procedures, the recruitment and training of staff, and the acquisition of facilities, equipment, and materials needed to provide *active* protection during emergency response’ (Committee on Disaster Research in the Social Sciences, 2006:86). Mitigation and preparedness measures are feasible for both natural disasters (e.g., strengthening of the structural elements of office buildings and installing smoke detectors) and technological ones (e.g., steel casings around oil and gas wells). Since the adoption of hazard adjustments by organizations may help ameliorate the impacts of disasters, it is worth exploring organizational characteristics that predict hazard adjustments. Hazard adjustments are “...actions that intentionally or unintentionally reduce risk from extreme events in the natural environment” (Lindell and Perry, 2000, p. 461-462).

Preliminary evidence from the disaster literature suggests that an organizational risk manager is important in disaster planning (Sadiq and Weible, 2010). A risk manager, among other duties, is responsible for informing employees about the risks their organization is

susceptible to, the hazard adjustments the organization is using to address those risks, and what employees should do in the event of a disaster (e.g., whether or not employees should evacuate the building or shelter in place during a particular disaster). Unfortunately, there is little empirical evidence that the presence of a designated risk manager is associated with the adoption of hazard adjustments in organizations.

In addition, the risk perception literature is mixed on the relationship between risk perception and the adoption of hazard adjustments. Studies have found a positive and significant relationship between risk perception and preparedness (Han and Nigg, 2011; Sadiq, 2009), while others have found otherwise (e.g., Milne, Sheeran, and Orbell, 2000). This study contributes some evidence to this debate. Thus, the purpose of this study is to empirically answer two research questions in the context of both technological and natural disasters. (1) “Is having a risk manager associated with the adoption of hazard adjustments?” (2) “What is the relationship between risk perception and the adoption of hazard adjustments at the organizational level?”

Data collected from 227 public, private, and non-profit organizations in the Memphis/Shelby County area, Tennessee in 2006 were used to provide answers. This study finds a significant positive relationship between the presence of risk managers in an organization and the adoption of hazard adjustments. The results also indicate that organizational risk perception has a significant positive relationship with the adoption of hazard adjustments. Our study adds to the literature on how organizations perceive both technological and natural hazard risks and respond to them (Alberto, 2011; Dynes and Drabek, 1994; Fowler, Kling, and Larson, 2007; Leveson et al., 2009; Light, 2008; Mitchell, 1995; Penrose, 2000; Sadiq, 2011; Schulman and Roe, 2007).

The article is organized as follows. The next section discusses relevant literature on the determinants of mitigation and preparedness (hazard adjustments). It is followed by a presentation of the methodology, data collection procedures, and the results. Finally, the study concludes by highlighting an agenda for future research in hazard adjustments at the organizational level.

## **Literature Review**

In this section, we review the determinants of mitigation and preparedness measures, but with a primary focus on two determinants: risk managers and risk perception. It is important to note that a majority of the studies examined were conducted in the United States.

### ***Determinants of Mitigation and Preparedness Measures (Hazard Adjustments)***

One of the fundamental goals of organizations is survival (Shafritz, Ott, and Jang, 2005). Survival is so important that organizational theorists have devoted much time to studying how organizations manage to survive (Pfeffer and Salancik, 1978). Disasters constantly threaten this goal by causing organizational disruption (Lindell and Perry, 2007), loss of sales and property taxes (Tierney, 1994), and loss of services from public, private, and non-profit organizations.

The challenge for organizations is to find ways of ensuring continuity of operations during and after disasters. Organizations stand a better chance of surviving disasters and continuing their day-to-day operations if they have preparedness and mitigation strategies in place before disasters strike (McManus and Carr, 2001). In the remainder of this section, we will discuss the determinants of mitigation and preparedness.

### ***Risk Manager***

An organizational risk manager is defined in this study as a designated employee (full-time or part-time) charged with designing, adopting, and/or implementing a range of risk management programs. The risk manager assesses organizational vulnerability to disasters and communicates potential risks and planned responses to organizational members through videos, pamphlets, and e-mails (Ward, 2001). Prior studies have established the important roles risk managers play in managing the risks faced by organizations (Corbett, 2004; Sadiq and Weible, 2010; Yoon, Youngs, and Abe, 2012), while others have studied the roles of risk managers in organizations (Ward, 2001). To the best of our knowledge, there is only one study—Yoon, Youngs, and Abe (2012)—that studied the relationship between risk manager and the adoption of hazard adjustments in organizations. Yoon, Youngs, and Abe, (2012) examined the factors that are associated with the development of FEMA-approved Hazard Mitigation Plans using Census data (N=50), they found that financial resources and disaster experience were influential factors in the development of FEMA-approved Hazard Mitigation Plans. However, they found a positive, but insignificant relationship between local emergency managers and the development of FEMA-approved Hazard Mitigation Plans. As a result of limited research on risk managers and hazard adjustments, this study examines the first research question: “Is having a risk manager associated with the adoption of hazard adjustments?”

An important factor in establishing an effective risk management program is the presence of a risk manager (Ward, 2001). Organizations might create a risk management office (centralized structure), headed by the risk manager, to implement and oversee risk management programs (Ward, 2001) or distribute the risk management function throughout the organization (decentralized structure) (Hage, 1965; Vitez, 2014; Zaharia, 2012). Centralization is a measure of power distribution in an organization (Hage, 1965). Under centralization, the risk manager has

the power to make risk management decisions and provide risk management direction for the organization (Vitez, 2014). Under the decentralized organizational structure, multiple individuals or departments are responsible for making risk management decisions (Vitez, 2014).

Organizations may hire risk managers with the expectation that they will help organizations gauge future risks, inform management of vulnerabilities, and promote steps to reduce risks from both technological risks and natural hazards. Ward (2001) notes that risk managers are in charge of developing and implementing risk management programs. This argument, which suggests a positive association between the presence of a risk manager in an organization and the adoption of hazard adjustments, provides the basis for Hypothesis 1.

There is, however, a counter argument. Organizations might hire risk managers to create a *false sense of security (or to foster an illusion of activity)*. In other words, organizations might hire a risk manager to signal to its employees that the organization is taking appropriate steps to manage its risks. Moreover, the hiring of a risk manager alone might lead executives and managers within the organization to develop too much confidence (*a false sense of security*) in the organization's risk-reducing activity (Pearson and Clair, 1998). Consequently, organizations may not provide the resources/authority that risk managers need to carry out risk management functions or grant access to higher-level decision making (Corbett, 2004). A recent survey in the United States on business recovery planning strategies revealed that a majority of the businesses surveyed were displaying a *false sense of security* (Pearce, 2013). Specifically, the survey found that most of the businesses had disaster recovery plans, but two-thirds of them relied on manual recovery processes, which may not meet recovery targets predetermined by the businesses (Pearce, 2013).

The notion of *false sense of security* is related to the organizational concept of a *paper plan syndrome* (Auf der Heide, 1989; Pearson and Clair, 1998) and the notion of fantasy document or fantasy planning (Clarke, 1999). The meaning of this concept is that an organization has a disaster plan on paper, but never fully implements it or even trains employees according to the plan. According to Auf der Heide (1989: 23), ‘one of the greatest impediments to disaster preparedness is the tendency to believe that it can be accomplished merely by the completion of a written plan.’ Additionally, Pearson and Clair (1998) argue that the existence of policies and procedures alone may give false signals of preparedness. Similarly, Clarke (1999: 16) maintains that such plans are ‘imaginative fictions about what people hope will happen when things go wrong’.

In summary, one should not assume that the mere presence of a risk manager will necessarily be associated with the adoption of hazard adjustments. An organization may exhibit the trappings of responsible risk management (e.g., a plan and a designated manager) but, in reality, undertake little or no risk management. Thus, Hypothesis 2 gives weight to the possibility of organizational illusion.

H1: An organization with a risk manager is more likely than an organization without a risk manager to adopt mitigation and preparedness measures.

H2: An organization with a risk manager is less likely than an organization without a risk manager to adopt mitigation and preparedness measures.



### *Risk Perception at the Organizational Level*

*Defining and Measuring Risk Perception.* In this study, risk perception is defined as the combination of the perceived likelihood and the perceived consequences of an activity or technology (Bubeck, Botzen, and Aerts., 2012). According to the Protection Motivation Theory (PMT) (Rogers, 1975; Rogers, 1983), threat appraisal, which is also referred to as risk perception by Grothmann and Reusswig (2006), is measured as the combination of perceived probability and perceived consequences. Some studies have measured risk perception as a combination of the two concepts (Grothmann and Reusswig, 2006), while others have measured risk perception as perceived probability only (Siegrist and Gutscher, 2006). Our survey did not seek to disentangle probability and consequences, instead, like some previous perception studies, our study measured the more integrative concept of degree of worry.

Studies of risk perceptions typically ask a respondent directly about their degree of concern/worry (or lack thereof) or about their view of danger to society as a whole (Siegrist and Cvetkovich, 2000; Slovic, 1987). Siegrist and Cvetkovich, (2000: 715) measured perceived risk by asking respondents the following question: “In general, how *risky* do you consider each of the following items to be for the United States society as a whole?” In our study, risk perception was measured by asking respondents to rate the worry level *for their organization*. The specific question in the survey is: “Using the thermometer scale below, please indicate the extent to which you perceive the following disasters are a worry for your organization”, on a scale of 0 (no worry at all), 50 (moderate worry), and 100 (a great deal of worry). The survey then listed 15 different disasters (Bird flu/pandemics, chemical spills, drought, earthquakes, extreme heat, extreme winds/tornadoes, fires, flooding, hurricanes, ice storms, severe storms, terrorist attacks, toxic releases, violent crimes, and water pollution).

*Related Literature on Risk Perception.* Some researchers have examined risk perception at the household (Lindell, 2013) and organizational levels (Han and Nigg, 2011), but most risk perception research has focused on individual risk perception and how risk perception relates to individual choice such as the acceptability of risk (Helsloot and Ruitenber 2004; Slovic, 1987; Slovic, 2000). With regard to the type of risks, previous researchers have studied individuals risk perception of technological risks (Bubeck, Botzen, and Aerts., 2012; Slovic, 1987; Slovic, 2000; Slovic, Fischhoff, and Lichtenstein, 1980), environmental or natural hazards (Mileti and Darlington, 1997; Perry and Lindell, 2008; Solberg, Rossetto, and Joffe., 2010; Wachinger et al., 2013), and a combination of the two (Fowler, Kling, and Larson, 2007; Sadiq, 2009).

The risk perception literature is mixed on the relationship between risk perception and hazard adjustments. The current study contributes to this debate by examining the second research question: “What is the relationship between risk perception and the adoption of hazard adjustments at the organizational level?” Studies that have found a positive and significant relationship between risk perception and preparedness include Han and Nigg (2011) and Sadiq (2009). Perry and Lindell (1997) also found that managers’ risk perceptions had a significant correlation with the adoption of hazard adjustments within their agency. In addition, Lindell and Perry’s (2000) summary of 23 earthquake studies and Lindell’s (2013) summary of 20 correlations related to a variety of hazards found a generally positive relationship between risk perception and risk-management measures.

This study employs the Crisis Management Process Model of Pearson and Clair (1998) as the conceptual guide to understanding the relationship between risk perception and the adoption of hazard adjustments in organizations. Pearson and Clair’s (1998) model consists of three primary pre-event constructs and organizational crisis outcome concepts. The focus of this study

is on the pre-event constructs: environmental context of organizations (e.g., institutionalized practices and industry regulations), executive perceptions of risks, and the adoption of organizational crisis management preparations. We focus particularly on the relationship between executive perceptions of risks and the adoption of organizational crisis management preparations. Pearson and Clair's (1998: 69) model proposes that '...executive perception about risk ... will foster adoption of crisis management programs.' In short, Pearson and Clair's model and the above studies that show a positive significant relationship between risk perception and hazard adjustments provide the conceptual basis for hypothesis 3.

H3: Organizational risk perception leads to the adoption of mitigation and preparedness measures.

#### *Organizational Size*

Researchers have found that larger organizations are more likely to mitigate and prepare for disasters than smaller organizations (Drabek, 1991; Drabek, 1994a; Drabek, 1994b; Drabek, 1995; Quarantelli et al., 1979; Sadiq, 2010, 2015). Furthermore, studies have shown that, among a variety of independent variables tested, firm size is the most consistent (Dahlhamer and D'Souza, 1997) and important (Webb, Tierney, and Dahlhamer, 2000) predictor of organizational mitigation and preparedness. One interpretation is that larger firms devote more resources to disaster mitigation and preparedness than smaller firms, presumably because larger firms have more resources available to them and have more to lose (Dahlhamer and D'Souza, 1997; Mileti and Darlington, 1997; Tierney, 2006). Resource availability has been found to be a significant predictor of mitigation and preparedness at the organizational level, as well as at the

household (Mileti, 1999) and community (May and Birkland, 1994) level. Firm size may also act merely as a surrogate for a variety of other variables that are difficult to measure like the planning horizon of executives and the presence of professionalized boards of directors with a stake in the organization's future. Thus, the organizational size variable is best understood as capturing the influence of a variety of predictive factors that are correlated with the size of the organization.

#### *Ownership Pattern*

Organizational ownership patterns—whether the organization is a single firm or a franchise—may be related to the adoption of hazard adjustments. Empirical evidence suggests that franchises do more to mitigate and prepare for disasters than single firms. Drabek (1991, 1994a, 1994b, 1995) found firms that were part of a larger chain engaged in more disaster evacuation planning than single firms did. This finding is consistent with that of Quarantelli et al. (1979) who found that national chemical companies were more prepared than single local chemical firms. Dahlhamer and D'Souza (1997) provide a possible explanation for this finding by arguing that this difference could be due to the preparedness mandates given by corporate headquarters to local chapters.

#### *Organizational Sector*

Some sectors engage in more mitigation and preparedness than others. Drabek (1991, 1994a, 1994b, 1995) found that there was a significant relationship between business type and disaster evacuation planning, with lodging businesses having more extensive disaster evacuation plans than restaurants, entertainment businesses, and firms in the travel industry. Similarly, in their study of 54 firms on preparedness for earthquakes in San Francisco, Mileti et al. (1993) found an indirect relationship between firm type and earthquake preparedness. Further, Dahlhamer and

D'Souza (1997) found that businesses in finance, insurance, and real estate are better prepared for disasters than businesses in other sectors. This finding might be explained by the higher degree of regulation and oversight in this sector (Webb, Tierney, and Dahlhamar,2000), though adequate measures of regulation and oversight have not yet been developed to test this hypothesis rigorously.

### *Disaster Impact*

Research on risk and disaster visualizations suggests that information on the potential impacts of disasters can motivate people to take steps to reduce their risks (Sandman, Weinstein, and Miller 1994). In other words, a high level of awareness and concern about the impact of disasters may result in greater engagement in preparedness activities (Nigg, 1996). Indeed, a series of studies conducted on mitigation and preparedness among organizations in Memphis, Tennessee found significant positive associations between concern over the impact of both technological and natural disasters and the adoption of mitigation and preparedness measures (Sadiq, 2009; Sadiq, 2010).

### *Internal Organizational Obstacles*

This study defines internal obstacles to disaster mitigation and preparedness as factors inside an organization that inhibit the ability of the organization to mitigate and prepare for disasters. We consider three major categories of internal obstacles: lack of information, lack of managerial and rank-and-file member motivation/support, and lack of financial resources.

The acquisition of information (e.g., forecasts of future disasters) is an important ingredient to disaster preparedness (Huss, Sadiq, and Weible, 2012; Major, 1998; Perry and Lindell, 1997) because it helps organizations understand their vulnerabilities and guides choices about how to allocate resources toward mitigation, preparedness, response, and recovery. It is

also important that management and rank-and-file members of the organization are motivated to support the adoption of mitigation and preparedness measures (Whitney, Dickerson, and Lindell, 2001). Finally, a lack of financial resources is likely to inhibit an organization from adopting measures (Bostrom, Turaga, and Ponomariov, 2006; Pearson and Clair, 1998; Wyner and Mann, 1986). Because these three obstacles can hinder the ability of a risk manager to carry out his/her risk management function or can discourage an organization from adopting hazard adjustments, it is necessary to control for them in the analysis. By controlling for these obstacles, the influences of risk manager and risk perception on hazard adjustments can be better understood. The focus on internal organizational obstacles is not intended to deny the importance of external factors influencing organizational readiness. Information on external obstacles were not included in the survey.

## **Methods**

In this section, the procedure for data collection is outlined along with a discussion of the uniqueness of the data. Variable measurements, including the specific survey questions used for measuring the values of the variables, are presented. Following variable measurement is a discussion of the choice of statistical technique-ordinary least square (OLS) and logistic regressions.

### ***Data Collection***

Data were collected from the Memphis/Shelby County area, Tennessee, in 2006, an area where earthquake hazards are of particular concern due to actuarial experience. One of the authors was a member of a research team that collected these data from a sample of public, private, and non-profit organizations. The research team began by conducting exploratory interviews with fifteen

different organizations in Memphis/Shelby County, Tennessee. Interviewees were asked open-ended questions about the type of actions their organizations had taken in respect to risk, as well as their attitudes toward hazard risk management and risk information. The interviews were conducted either in person or via telephone in the spring and summer of 2006. Each interview took approximately 30-60 minutes. Following those interviews, the research team processed the responses and returned them to the interviewees to verify accuracy. The results of the exploratory interviews were then used to develop the survey instrument utilized in phase two.

In the fall of 2006, a survey was mailed to 733 organizations in Memphis/Shelby County, Tennessee. The two-part survey consisted of (1) questions regarding risk issues in organizations and the actions organizations were taking to address risks and (2) questions about demographic characteristics of the respondents. The survey was distributed using a stratified sampling technique. With the help of the Memphis Regional Chambers of Commerce, the research team queried an online reference service, *ReferenceUSA*, using *number of employees* as a key index variable to allow organizations of all sizes in the Memphis Metropolitan Area to be surveyed and represented in sufficient numbers. The categories ranged from no employees to over 9,999 employees. The research team re-categorized the number of employees into seven distinct categories (1-9, 10-19, 20-49, 50-99, 100-249, 250-499, and  $\geq 500$ ) and randomly selected 100 organizations from each of the first six categories, all 101 organizations from the seventh category, and then added 32 utility companies<sup>1</sup> in Memphis/Shelby County area for a total of 733 organizations.

The survey was administered using a modification of Dillman's total design method, which is designed to achieve optimum response rates by using a system of re-mailings and reminders (Dillman, 2000). Using the letterhead of the University of Memphis, the team mailed a

letter to each of the 733 organizations describing the study and seeking participation. Following this, the research team mailed the first batch of surveys and follow-up postcards. Then, a second batch of surveys was sent out. Of the 733 organizations, 227 returned the survey, yielding a response rate of 31 per cent. This response rate is within the range achieved by previous organizational-level studies on disasters (e.g., the response rate for Han and Nigg (2011) was 33.6 per cent). Although the survey was addressed to the owners and risk managers of the 733 organizations, those that actually answered the survey were: Risk Managers (N=51), Owners (N=44), Presidents and Vice Presidents (N=39), Chief Executive Officers (N=34), Executive Directors (N=12), Principals (N=12), Administrators (N=6), Religious Leaders (N=4), and others (N=7).<sup>2</sup> We assume that these respondents are knowledgeable about their organizations (including knowledge of risk management issues) and that their responses on the survey represent their organizations' views.

### ***Variable Measurement: Dependent Variable***

#### *Hazard adjustments*

Hazard adjustments were operationalized by 10 disaster mitigation and preparedness activities (see Table 1). This dependent variable was assessed by the responses to the question: "Has your organization engaged in any of these activities over the past year?" Respondents could either answer "yes" or "no". A ten-item index was generated by summing together the responses for each organization (Cronbach's alpha = 0.88). An alternative formulation of the ten mitigation and preparedness activities—active and passive measures—was also developed (see Table 1) based on previous work by Sadiq (2010) and Sadiq and Noonan (2015). One index each was created for active and passive measures by adding the active measures together (Cronbach's alpha =



0.81) and the passive measures together (Cronbach's alpha = 0.83). Active measures are those activities that involve an organization actually doing something to address its risks. Passive measures are activities that involve an organization simply discussing or mentioning hazard adjustments that need to be taken. Active measures are more capable of reducing the impacts of disasters on organizations than passive measures. As a result, organizations that adopt active measures may stand a better chance of surviving disasters in comparison to those that adopt passive measures only.

Table 1. Active and Passive Hazard Adjustments.

Hazard Adjustments
<p><u>Active</u></p> <ol style="list-style-type: none"> <li>1. Attended disaster meetings/training courses outside your organization</li> <li>2. Held disaster-related workshops/training within your organization</li> <li>3. Arranged site visits by consultants or experts to better prepare for disasters</li> <li>4. Provided information to customers/members of the community on issues related to disasters</li> <li>5. Assessed or evaluated vulnerability to disasters or estimated potential losses from disasters</li> <li>6. Engaged in non-structural mitigation measures (e.g., securing computers)</li> <li>7. Engaged in structural mitigation measures (e.g., strengthening parts of a building)</li> </ol>
<p><u>Passive</u></p> <ol style="list-style-type: none"> <li>1. Mentioned a potential disaster in an organizational meeting</li> <li>2. Discussed in an organizational meeting short-term responses to disasters</li> <li>3. Discussed in an organizational meeting long-term strategies for recovery from disasters</li> </ol>

### ***Variable Measurement: Independent Variables***

#### *Presence of a risk manager*

The study is not the first to use the presence of a risk manager as an independent variable to explain hazard adjustment adoption. Yoon, Youngs, and Abe, (2012) used the number of emergency management specialists/emergency managers (same as risk managers) as an independent variable for explaining the development of FEMA-approved Hazard Mitigation Plans. The presence of a risk manager in this study is measured by responses to the following question: “Does your organization have a risk manager?” Respondents could either answer “yes” or “no”. As an independent variable, it is coded 1 for organizations that have a risk manager and 0 for organizations that do not have a risk manager or that have decentralized risk management responsibilities.

#### *Risk Perception*

This variable is assessed by responses to the following question: “Using the thermometer scale below, please indicate the extent to which you perceive the following disasters are a worry for your organization”, on a scale of 0 (no worry at all), 50 (moderate worry), and 100 (a great deal of worry). The survey listed fifteen different disasters (Bird flu/pandemics, chemical spills, drought, earthquakes, extreme heat, extreme winds/tornadoes, fires, flooding, hurricanes, ice storms, severe storms, terrorist attacks, toxic releases, violent crimes, and water pollution). An index was created by adding together the responses for all fifteen disasters (Cronbach’s alpha = 0.89).

### *Variable Measurement: Control Variables*

The previous literature suggests other variables may be important predictors of hazard adjustments. The following variables were controlled for—organizational size, ownership pattern, organizational sector (education, health, and wholesale/retail trade sectors), disaster impacts, and internal organizational obstacles.

#### *Organizational Size*

This variable was measured as the number of full-time employees in an organization. Memphis Regional Chambers of Commerce provided the information.

#### *Ownership Pattern and Organizational Sector*

Memphis Regional Chambers of Commerce also provided information on whether an organization is a single firm or part of a franchise, and the sector to which an organization belongs.

#### *Disaster Impact*

This variable was generated from responses to the following question: “Please indicate the extent to which the following disaster impacts might adversely affect your organization” on a five-point scale, with 1 indicating minor adverse impact and 5 indicating major adverse impact. The thirteen disaster impacts are: (i) damaged reputation, (ii) disruption in supplies or deliveries, (iii) inability to communicate with employees, (iv) inadequate number of employees, (v) loss of commercial goods, (vi) loss of customers, (vii) loss of data, (viii) loss of life, (ix) loss of life support (food, water, etc.), (x) loss relative to competitor’s loss, (xi) power outage, (xii) structural damage, (xiii) transportation disruption. An index, mean disaster impact, was created for this variable by adding together the values for all thirteen disaster impacts (Cronbach’s alpha = 0.81) and dividing by thirteen.

### *Internal Organizational Obstacles*

The values of this independent variable were generated from responses to the following survey question: “Please indicate the extent to which the following statements are obstacles to disaster planning in your organization”: (a) lack of financial resources to prepare for disasters, (b) lack of support from upper-level management within your organization, (c) lack of support from mid- and lower-level organizational members, (d) lack of information about the frequency and magnitude of disasters, (e) lack of convincing information about the potential impacts of disasters, (f) unclear organizational benefits from disaster planning and mitigation. The scale of the variables is 1 to 5 (minor to major obstacle). An index, the mean of all the obstacles, was created by adding together the values for all the obstacles (Cronbach’s alpha = 0.85) and dividing by six.

### *Statistical Analysis*

Prior to carrying out the statistical analyses, this study makes two assumptions. First, some organizations in the sample may have gotten rid of some unmeasured hazard adjustments. Those organizations are regarded as having negative values for mitigation and preparedness measures. Second, there are some organizations in the sample that engaged in more than ten mitigation and preparedness measures over the past year. For instance, some organizations might have stored water and food in addition to adopting all ten mitigation and preparedness measures. The sample was restricted during the analyses by bounding the dependent variable between zero (lower limit) and ten (upper limit). In other words, the dependent variable is censored from both left and right, meaning that one cannot observe organizations that are below zero or above ten.

Prior to the multivariate regressions, a correlation analysis was carried out among all the variables. The goal of the correlation analysis is to understand the relationship between the dependent variable and each of the independent variables. After the correlation analysis, a Tobit regression was estimated to answer the two research questions. Tobit is the appropriate technique for analysing censored samples because it gives a precise estimate of the relationship between the dependent and independent variables (Gujarati 2011). In addition, an OLS regression was estimated for comparison to the Tobit results. Finally, a Logit regression was used to understand the relationship between individual mitigation and preparedness measures and the presence of a risk manager as well as between individual mitigation and preparedness measures and risk perception. Logit is appropriate in this case because of the binary nature of the responses.

## **Results**

According to Table 2, organizations in the sample adopted an average of 4.7 out of 10 hazard adjustments. About 44 per cent of organizations in the sample have a risk manager and approximately 56 per cent do not have a risk manager. With regard to risk perception, the mean risk perception for the sample is about 457 and the maximum is 1365 (standard deviation = 285.31).

Table 2. Descriptive Statistics.

Variable	Obs.	Mean	Std. Dev.	Min	Max
Hazard Adjustments	206	4.74	3.27	0	10
Risk Manager	207	.44	.50	0	1
Risk Perception	224	456.90	285.31	0	1365
Single Location	218	.78	.42	0	1
Employee Size	215	5.79	2.08	1	11
Mean Disaster Impact	220	3.64	.76	1	5
Mean Obstacle	212	2.51	1.37	0	5
Educational Sector	225	.08	.27	0	1
Health Sector	225	.16	.36	0	1
Whole Sale/Retail Sector	225	.15	.36	0	1

Table 3 presents the intercorrelations among all the variables. There is a significant and positive association between the adoption of hazard adjustments and the presence of a risk manager (.58). Similarly, there is a significant and positive association between hazard adjustments and risk perception (.38).

Table 3. Intercorrelations Among All Variables (N=180)

	1	2	3	4	5	6	7	8	9	10
1. Hazard Adjustments	1.00									
2. Risk Manager	0.58	1.00								
3. Risk Perception	0.38	0.23	1.00							
4. Single Location	-0.28	-0.29	-0.22	1.00						
5. Employee Size	0.48	0.28	0.21	-0.11	1.00					
6. Mean Disaster Impact	0.12	0.11	0.41	0.11	0.11	1.00				
7. Mean Obstacle	-0.27	-0.18	0.02	0.01	-0.11	0.26	1.00			
8. Educational Sector	0.20	0.24	0.07	0.16	0.10	-0.07	0.05	1.00		
9. Health Sector	0.10	0.02	-0.00	0.17	0.14	0.09	-0.04	-0.13	1.00	
10. Wholesale/Retail Sector	-0.34	-0.19	-0.15	-0.04	-0.10	-0.10	0.09	-0.12	-0.18	1.00

All significant correlation at  $p < .05$  level are highlighted in gray.

Table 4 presents the results of the OLS (both unstandardized and standardized coefficients) and Tobit regressions. Both models show that having a risk manager significantly increases the likelihood of adopting hazard adjustments. Taking the OLS result as an example, holding all other variables constant, the presence of a risk manager is associated with a 2.06 increase in the number of hazard adjustments. The other variable of interest, risk perception, has a positive and significant relationship with the adoption of hazard adjustments in both models. The OLS results indicate that, holding all other variables constant, a one unit increase in risk perception increases the number of hazard adjustments adopted by 0.0017. Single location, mean obstacle to disaster planning, and wholesale/retail sector all have negative and significant

relationships with hazard adjustments. In addition, employee size and educational sector have

Variable	OLS Coefficient (Std. Error)	Beta (OLS)	Tobit Coefficient (Std. Error)
Risk Manager	2.06*** (.3842)	.32	2.22*** (.4640)
Risk Perception	.00* (.0007)	.14	.00* (.0009)
Single Location	-1.30** (.4465)	-.17	-1.59** (.5404)
Employee Size	.49*** (.0859)	.31	.59*** (.1045)
Mean Disaster Impact	-.04 (.2564)	-.01	-.11 (.3127)
Mean Obstacle	-.37** (.1282)	-.16	-.42** (.1556)
Educational Sector	1.18 (.6348)	.11	1.28 (.7606)
Health Sector	.47 (.4737)	.05	.68 (.5662)
Wholesale/Retail Sector	-1.70*** (.4808)	-.19	-2.30*** (.6015)
Constant	2.32* (1.0861)		1.99 (1.3142)
Observations	180		180
Adj. R <sup>2</sup> (Prob. > F = 0.0000)	.53		
Pseudo R <sup>2</sup> (Prob. > Chi <sup>2</sup> = 0.0000)			.15

positive and significant relationships with hazard adjustments.

Table 4. Ordinary Least Square and Tobit Regression Results.

Note \*\*\* $p < .001$  \*\* $p < .01$  \* $p < 0.05$

The results of the active and passive Tobit analyses indicate that there is a significant and positive relationship between having a risk manager and the adoption of both active and passive measures. Also, organizational risk perception is associated with the adoption of both active and passive measures. Further, the results of the ten Logit regressions show that having a risk



manager is associated with eight of the ten hazard adjustments. In addition, risk perception is significantly associated with four of the ten hazard adjustments.

## **Discussion**

The results of the intercorrelations support those obtained from the OLS and Tobit regressions. The OLS and Tobit analyses provide empirical evidence in support of Hypothesis 1. That is hiring a risk manager is positively associated with the adoption of hazard adjustments. On the contrary, the OLS and Tobit regressions do not provide empirical evidence in support of Hypothesis 2 or the *paper plan syndrome/false sense of security/fantasy document*. In other words, there is no indication that organizations in our sample are hiring risk managers for the purpose of creating a false sense of security. Rather, the results suggest that organizations that have risk managers are more likely than organizations without risk managers to adopt hazard adjustments. Further, the results from the active and passive analyses suggest that hiring a risk manager is positively associated with the adoption of both active and passive hazard adjustments.

The intercorrelations result between hazard adjustment and risk perception corroborates those from the OLS and Tobit regressions. The OLS and Tobit results provide empirical evidence in support of Hypothesis 3, and suggest that organizational risk perception is positively associated with the adoption of hazard adjustments, although the effect sizes are small. This finding is in agreement with those of previous studies on risk perception (Han and Nigg, 2011; Sadiq, 2009) as well as with the Crisis Management Process Model proposition (Pearson and Clair, 1998). Finally, the results from the active and passive hazard adjustments analyses indicate that organizational risk perception is associated with the adoption of both active and passive measures. Although risk perception has a medium sized correlation with hazard adjustment, its

incremental effect is small when included with risk manager and employee size. These results are in line with Solberg Rossetto, and Joffe's (2010) conclusion that previous studies have found a weak relationship between seismic risk and seismic adjustments.

The significant relationship demonstrated by this study suggests that risk managers could make a big difference when it comes to adopting hazard adjustments in organizations, particularly proactive measures that can actually reduce the impacts of disasters on organizations. Nonetheless, it is important for the risk manager to recognize the importance of involving other departments in current and future risk management programs. A prerequisite for the success of any risk management approach is collaboration between the risk management office and the entire cadre of employees in other departments. Such collaboration, at a minimum, may build trust, improve coordination, and ultimately, make the organization more effective in reducing disaster risks.

The finding regarding the relationship between hazard adjustments and organization size is quite interesting and consistent across the correlation analysis, OLS regression, and the Tobit regression. According to all three analyses, there is a significant and positive relationship between the two variables. In addition, organization size has the biggest beta coefficient among all the independent variables. This robust finding is in line with the results of myriad studies on hazard adjustments (Quarantelli et al., 1979; Sadiq, 2010, 2015). The reason for this result, according to researchers is that larger organizations have more resources than smaller organizations that they can devote to the adoption of hazard adjustments (Dahlhamer and D'Souza, 1997; Mileti and Darlington, 1997; Tierney, 2006).

As with any empirical study, there are some limitations to the current study. First, because the study is based in Memphis/Shelby County region, the results are not easily

generalizable to other parts of the country or the world. Second, the “presence of a risk manager” measure is likely to capture organizations with a centralized risk management function, but is unlikely to capture organizations that spread their risk management function across multiple jobs in various departments (decentralized structure). Third, because the data were collected in 2006, the findings may not reflect current risk perceptions and preparedness levels among organizations in Memphis/Shelby County, Tennessee. Fourth, this study establishes an association between the presence of a risk manager and the adoption of risk-reducing measures. Such association does not necessarily reflect a causal relationship running from the manager to the measures. It is quite possible that some reverse causation is operating. Moreover, in a cross-sectional survey of organizations, we cannot discern whether the risk manager was hired prior to the adoption of risk-reducing measures or whether the manager may have been hired after the measures were adopted. Fifth, our treatment of organizations might suggest that they are all the same. Although, we controlled for organizational characteristics like size and industry, there are other organizational characteristics we did not control for such as organizational culture. Finally, there are some determinants of organizational mitigation and preparedness not included in the analysis due to unavailable information. These determinants are previous experience with disasters (Barlow, 1993; Drabek, 1994a; Drabek, 1994b), whether a business leases or owns the property where they operate (Dahlhamer and D’Souza, 1997), the age of an organization (Drabek, 1991; Quarantelli et al., 1979), and industry regulations (Pearson and Clair, 1998). With regard to industry regulations, Pearson and Clair’s (1998) comprehensive model of crisis management process suggests that industry regulations could mandate organizations to adopt risk-reducing measures (Person and Clair, 1998). Despite these

limitations, this study adds encouraging empirical information to the literature on organizational perception and management of natural and technological risks.

## **Conclusion**

The purpose of this study is to determine whether a designated risk manager is associated with a stronger portfolio of hazard adjustments and whether organizational risk perception is associated with the adoption of hazard adjustments. This study finds a significant positive relationship between the presence of risk managers and the adoption of hazard adjustments. The results also indicate that organizational risk perception has a small positive influence on the adoption of hazard adjustments.

The data collected by the research team and used in this study are unique in two ways. First, most studies on disaster preparedness focus on specific hazards (Mileti, 1999). Our data contain information on mitigation and preparedness measures for multiple types of technological risks and natural hazards. Secondly, very few researchers have collected data on organizational behaviour in relation to disaster preparedness and mitigation measures.

Future research should seek to control for a broader range of predictors of organizational preparedness such as industry regulations (Pearson and Clair, 1998) as well as organizational structures, size, complexity, and management attitudes towards risk. Also, future studies should examine whether the type of risk manager matters (e.g., full-time versus part-time and placement within the organization) and whether the resources allocated to risk managers have an impact. By isolating which aspects of the risk manager's role are most important, researchers can provide clues about how a culture of risk management may be infused into all units within an organization (Ward, 2001). Furthermore, future research should be undertaken to uncover why

some organizations hire risk managers and others do not. Moreover, some time-series information on risk managers and the adoption of measures would be useful in shedding light on some of the complicated causation issues (Siegrist, 2013). Lastly, researchers should replicate this study and examine whether or not organizational risk perceptions and preparedness levels have changed since the data for this study were collected. It would also be valuable to exploit nationally representative samples. In so doing, we may be able to gain a better understanding of the predictors of hazard adjustments and produce generalizable findings.

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<sup>1</sup> The research team was interested in understanding the preparedness levels in this particular critical infrastructure because utility companies play a crucial role in the response and recovery of communities following a disaster.

<sup>2</sup> Job title information was not available for 18 out of the 227 respondents.