FARMERS’ FOOD SECURITY PREPAREDNESS
BASED ON RISK PERCEPTION

By

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Abstract: Agriculture is intrinsically exposed to risks that could threaten food security across the globe. In the farming community, it is critical to understand what farmers perceive as the greatest risks to their operation, what activities they use to mitigate for those risks, and where the information about those risks and mitigation activities is obtained. To answer this, a qualitative, deductive, pragmatic study of Arkansas poultry and cattle farmers was conducted utilizing semi-structured interviews and critically examining the transcripts. Protection Motivation Theory is the theoretical lens utilized in this research to investigate farmers’ threat appraisals, coping appraisals, and information seeking attitudes towards risks that may influence their mitigation activities. Farmers state that weather events such as drought, floods, and extreme temperatures; diseases such as Avian Flu; and predators such as coyotes, wild hogs, and even humans are some major concerns for their operation. To mitigate these risks, farmers engage in some mitigation activities such as providing shelters, vaccinating animals, implementing biosecurity practices, getting guard animals, and putting up protective enclosures. While farmers recognize that there is a plethora of risks such as weather, disease, injury, and predators that are potentially destructive to their operation, it is ultimately monetary pressures that are perceived to be the biggest risks to their operations. It is also monetary pressures that influence farmers to engage in mitigation activities for those risks. When the farmers were asked if the government could be of assistance to mitigate the risks, most farmers did not want any government help on their operation, even if they were receiving government grants and subsidies. While this research primarily sought to understand farmers’ risk perceptions and mitigation activities, it also found that the preferred method of informational seeking about risks was dependent on age. Younger generation farmers were more likely to look to social media and the internet for information about risks and mitigation activities, while older generation farmers relied on indigenous knowledge, friends, and family.

Key Words: food security, emergency management, protection motivation, farmers
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Farmers, as the stewards of our food production, play a vital role in promoting sustainable agriculture to ensure food security. They navigate a complex landscape where the potential for both natural and human-caused risks loom large. Weather, disease, predators, and profitability are just some of the risks that abound in farming. Weather, such as drought, flood, and wind threaten farming operations as do plant and animal diseases. In order to reduce losses from the many risks threatening agriculture, farmers must understand the risks and engage in hazard mitigation activities.

In a developed country like the United States, it is easy to become complacent about food security. It is anticipated that by the year 2050 the world population will surpass nine billion people, and in an effort to meet food demand requirements, agricultural production will need to increase by 70 percent (De Castro et al., 2012). At the same time, hazards may be increasing in frequency and intensity due to climate change, which threatens the global ability to increase food production at sufficient rates.
Using Protection Motivation Theory, this research provides insight into how farmers understand risks to their farming operations, willingness to utilize adaptation practices that mitigate risks, and where they receive information about potential risks and mitigation activities. This research provides insight into what farmers perceive as “food security risks”, by asking farmers to identify risks to their operation. While there are some safety nets like insurance and government subsidies that aid in mitigating potential impacts of adverse events, there are other strategies utilized to protect a farming operation from potential risks. Protection Motivation Theory posits that individuals' behaviors are influenced by threat appraisals and coping appraisals (Rogers, 1975; Rogers and Prentice-Dunn, 1997; Floyd, Prentice-Dunn, and Rogers, 2000).

Reliable data is imperative to farmers so that they can stay informed on the latest details on weather forecasts, market trends, and even insurance information. A diversity of information sources ranging from government, science, and word-of-mouth from friends and family is available to farmers and plays a role in the decision-making process. It is important to explore where farmers receive their information so that policy makers, farmers, and researchers can figure out the best means to disseminate information about potential risks and mitigation activities.

Mitigation is important, but it is also costly. There is a heightened level of uncertainty about appropriate mitigation activities on farms as well as where farmers can access information pertaining to mitigation activities. While farmers’ risk aversion reflects a multitude of external factors such as weather or input costs, farmers are less likely to engage in mitigation activities because they do not want to lose the money up front when they can be guaranteed gains.

Food security is one of the most demanding tasks facing society (McDonagh, Farrell, and Conway, 2017). Food insecurity persists even with all modern technological advances. This is why it is critical to understand what farmers see as risks, what risks they are mitigating, and where they are obtaining
this information in an effort to reduce any further insecurity to farming resources. Sustainable agriculture is important for food security.

There has been little research on this topic as it pertains to fire and emergency management. This study is exploratory in nature and has the potential to lay groundwork for future analysis and studies as there is little preexisting knowledge on this topic as it pertains to poultry and cattle farms. Communities in Arkansas rely heavily on agricultural driven jobs. The poultry industry in Arkansas supports over 40,000 jobs and accounts for 40% of the total agricultural cash receipts (USDA-NASSb., 2023; UADA, 2023). While these stats display high revenue and offer numerous jobs for the state, it could also be detrimental in the event of a disaster if farmers are not adequately equipped to handle a threat or risk. For this reason, this study examines risk perception, protective action and mitigation activities, and information seeking in the Arkansas poultry and cattle industry.

Aims and Objectives

Using the theoretical lens of Protection Motivation Theory, this study aims to examine how Arkansas farmers understand risks to their farming operations and how they make decisions about hazard adjustment and mitigation activities.

Supporting objectives:

1. Construct a comprehensive literature review related to risks, hazards, information seeking, and hazard adjustments for farmers.
2. Assess farmers’ risk perception, information seeking, and mitigation strategies by purposive sampling and semi-structured interviews using Protection Motivation Theory as a framework.
3. Critically analyze themes of risk perception, information seeking, and mitigation strategies through content analysis from the interviews.
4. Formulate recommendations for theory and practice based on the research findings.
Impact of Food Security

The World Food Summit (1996) declared the existence of food security occurs “when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life”. It is easy to be complacent about the current food prospects and crop yields of the twenty-first century. However, two of the greatest challenges facing the world in the future are food and water shortages (Wutich and Brewis, 2014). By the year 2050, it is expected that the world population will exceed nine billion people, and in an effort to satisfy food demand, there will need to be a 70 percent increase in agricultural production (De Castro et al., 2012).

Globally, 38 percent of land surface is used for agriculture (Food and Agricultural Organization (FAO), 2020). Roughly one-third is utilized for crops, while the remaining two-thirds are used for livestock (FAO, 2020). In the United States, nearly 20 million jobs are related to agricultural and food sectors with 2.6 million of these jobs in farm employment (USDA, 2022). Of the 2.6 million jobs, there are nearly 255,000 agricultural sustained jobs in Arkansas (English, Popp, and Miller, 2014; IMPLAN, 2021).
The agricultural sector in the United States is complex, multilayered, and interdependent. According to United States Agency for International Development (2022), the term ‘food security’ includes having both physical and economic access to sufficient food in an effort to meet dietary requirements for a productive and healthy lifestyle. If an adverse event were to negatively impact the United States agriculture and livestock, there could be a detrimental impact on our food system, consequently impacting our economy and even the lives of millions of Americans (Gyles, 2010; Bhattacharjee, J., Bhattacharjee, D., & Samal, 2020). Risks that could potentially pose a threat to the agricultural sector include both natural emergencies and human-caused phenomena. Imminent threats that can impact agricultural sector include risks such as climate change, land degradation, resource scarcity; data breaches that cause supply chain disruptions, disease, and social influences (Department of Homeland Security, 2021; Gilpen et al., 2009). In 2022, the United States experienced weather and climate-related disasters that resulted in over $21.4 billion in crop and rangeland loss and damage (Munch, 2023). Hurricane Michael is another example of how detrimental a disaster can be to a farming operation. Hurricane Michael made landfall and hit agricultural communities in Florida and Georgia causing more than $2 billion worth in agriculture losses in Southern George alone (Diez, 2023). Farmers stated how the hurricane uprooted trees that take nearly a decade to grow, and that even 5 years in the aftermath they were feeling the toll of generational farming money being lost (Diez, 2023).

The USDA (2022a) reported that 10.5 percent of households in the United States suffer from food insecurity. Arkansas ranks number two in the worst food secure states in the United States (Arkansas Food Bank, 2022). In Arkansas, agriculture makes up 42 percent of the land and contributes approximately $20 billion to the state value (USDA NASS, 2021; USDA FS, 2021). Additionally, Arkansas ranks number 3 in broilers, number 4 in catfish, number 4 in turkeys, number 10 in chicken egg, and number 11 in beef cow production (USDA NASS, 2021). Arkansas is also prone to a number of hazards, such as flooding and tornadoes, that could
negatively impact overall food production which could have repercussions on local and national economies.

**Protection Motivation Theory**

This research utilizes Ronald Rogers’s (1983) Protection Motivation Theory for understanding the use of protective measures in response to food security threats, like climate change, droughts, disease, and other potential risks. Protection Motivation Theory (PMT) was originally developed by Roger (1975) to investigate how fear induced people to alter their health behaviors. The PMT looks to identify variables that influence people to protect themselves. Overall, Protection Motivation Theory outlines how threats are assessed and whether or not that prevention action will protect the subject and if they have the self-efficacy to implement the protective action.

Individuals perceive risks differently based on a number of factors, including familiarity, proximity, and the nature of the risk (Slovic et al., 1981; Slovic et al., 2004; Covello 1983; Renn, 1998). This research would serve to help agriculture, emergency management, and scientific communities understand how farmers' risk perception influences their protection motivation. More specifically, this research will be utilized to understand what farmers perceive as the biggest risks to their operation and what they may do to mitigate these risks. It will also examine information seeking and sources about potential threats and mitigation steps to reduce these possible risks.

Protection Motivation Theory suggests that protection motivation can be explained by examining farmers’ perceptions related to a risk and perceptions related to the efficacy of preventive measures together. These protective actions may include avoiding overcrowded breeding grounds and rearing conditions, vaccinating livestock, and practicing good biosecurity (e.g., maintenance of farm facilities such as coops and pens, cleaning tools, keeping visitors to a minimum) (Andres and Davies, 2015; Cunningham and Fairchild, 2009; Gill, 2015; Maye and Chan, 2020). It may
also include taking action against the risks of disease, climate changes, and accessibility to items that are vital to farm life (Mee et al., 2012; Altieri and Koohafkan, 2008).

Protection Motivation Theory (PMT) is utilized to understand how people process fears and threats, and how people choose to respond to these fears and threats. The theory was originally developed by Rogers (1975) to explain motivation to self-protect against a perceived health threat. Rogers’ works were based on fear appeal theories and works by Higbee (1969) and Leventhal and Watts (1966). Higbee (1969) looked to examine the conflicting findings (Janis, 1967, 1968a; Janis & Leventhal, 1968; Leventhal, 1965, 1967; McGuire, 1966, 1968; Miller, 1963) in regard to high threat versus low threat variables in persuasion. Higbee found that research by Janis and Feshback (1953) concluded that low threat is superior to high threat in persuasion to dental hygiene. In addition, a look into McGuire’s (1966) work found that when fear acted as a drive, it motivated people to accept recommendations. However, Higbee also found research where a positive relationship between fear and persuasion were found in instances of, “dental hygiene practices (Haefner, 1966; Leventhal & Singer, 1966; Singer, 1965), smoking (Insko, Arkoff, & Insko, 1965; Leventhal & Niles, 1964; Leventhal & Watts, 1966; Leventhal, Watts, & Pagano, 1967; Niles, 1964; Snider, 1962), tetanus inoculations (Dabbs & Leventhal, 1966; Kornzweig, 1968; Leventhal, Jones, & Trembly, 1966; Leventhal et al., 1965), safe-driving practices (Berkowitz & Cottingham, 1960; Leventhal & Niles, 1965), fallout shelters (Hewgill & Miller, 1965; Miller & Hewgill, 1966; Powell, 1965), tuberculosis (DeWolfe & Governdale, 1964), roundworms (Chu, 1966), proper viewing of the sun during an eclipse (Kraus, El-Assal, & DeFleur, 1966), and even the use of stairway handrails for safety (Piccolino, 1966)”. Higbee (1969) concluded that from the research reviewed, 1.) High fear arousal creates defensive avoidance reaction that causes high threat to be less persuasive than low threat is mostly not true. A majority of relevant research indicated high threat is superior to low threat in persuasion. 2.) Recommendations seem to increase efficacy of fear appeal, but positioning of the
recommendations in relation to the threat within communication is not important. 3.) Response to fear arousal varies depending on characteristics like coping style and feelings of vulnerability. 4.) High fear arousal seems more effective than low fear arousal if recipients view the message source as highly credible. 5.) There is no difference in learning factual materials in high or low threat communications. 6.) More research is needed to determine whether high fear arouses interests or depresses interests.

Leventhal and Watt’s (1966) research looked to expand upon previous research conducted by Leventhal and Niles (1964) which investigated the effects of fear-arousing communications and their impact on a persons’ intentions to stop smoking and take a chest x ray. Leventhal and Watts (1966) explored the effects of three variables in communications concerning smoking and lung cancer. These variables included, “(1) the threatening character of the communications, (2) perceived susceptibility to health and safety hazards, and (3) strength of smoking habit” (Leventhal and Watts, 1966). Leventhal and Watts (1966) concluded that people that experienced the high fear arousing film showed less compliance with the recommendation to take an X ray than those that viewed a medium or low fear arousing film. However, they did conclude that the high fear arousing group showed more likely to comply and go with the recommendation to decrease smoking (Leventhal and Watts 1966). Although there were some inconsistencies among the findings, the general trend supported that fear appeals were effective in generating in producing attitude change (Maddux and Rogers, 1982; Rogers, 1983; Shelton and Rogers, 1981).

In 1975, Rogers and Deckner discovered that cognitive appraisal of the threat along with efficacy of response resulted in message acceptance. In Rogers (1975) work, 3 (of the 4) components (probability of occurrence in a message lead to susceptibility perception, magnitude of harm lead to perceived severity, and explanations of effectiveness of recommended response led to perceived response efficacy. Bandura’s (1977) work on self-efficacy helped carve the road to Maddux and Rogers adding the self-efficacy component.
Rogers, Deckner, and Mewborn (1978) continued to support that high fear manipulation (displaying an operation on a lung cancer patient) had considerably increased the amount of adaptive behavior (smokers that were able to entirely quit). Rogers (1983) then postulated that there are two actions in predicting behavior: coping appraisal and threat appraisal. PMT describes that individuals that are confronted with a threatening event that they believe absence of protective action would create a greater threat to themselves (high threat appraisal), they will then engage in protective behavior (adaptive response) (Floyd, Prentice-Dunn, & Rogers, 2000; Kothe et al., 2019; Prentice-Dunn and Rogers, 2001; Prentice-Dunn, Floyd, and Flournoy, 2001; Rogers et al., 1997). Threat appraisal is contingent upon maladaptive response rewards, susceptibility, and threat severity (Kothe et al., 2019; Rogers et al., 1997). Maladaptive responses are avoidant reactions such as fatalism and denial (Grothmann and Patt, 2005). Maladaptive response rewards make reference to intrinsic and extrinsic advantages of abandoning a protective behavior; therefore, this construct negatively correlates with the intent to conduct protective action (Kothe et al., 2019; Rogers et al., 1997). Threat severity is an evaluation of the severity of the consequences of the event, where threat susceptibility examines personal perception to their susceptibility (perception of their vulnerabilities and suffering) (Prentice-Dunn & Rogers, 2001; Rogers et al., 1997). Protection Motivation Theory and previous research that has applied it, found that increased threat severity and susceptibility positively correlated with higher intent to participate in protective behavior (Prentice-Dunn & Rogers, 2001; Rogers et al., 1997).

The intent to adopt a protective behavior is determined by the precursors of coping appraisal, response efficacy, self-efficacy, and response costs. Coping appraisal considers alternative behaviors which may diminish a threat (Prentice-Dunn & Rogers, 2001). Response efficacy is the belief that prevention of the threat is possible by adopting protective behavior (Prentice-Dunn & Rogers, 2001; Rogers, 1997). Self-efficacy describes an individual’s perception of whether or not they are capable of carrying out a protective behavior (Prentice-Dunn & Rogers, 2001; Rogers et
Higher intent to engage in protective behavior is based on whether there is a higher level of self-efficacy and response efficacy (Prentice-Dunn & Rogers, 2001; Rogers et al., 1997). Alternatively, if perceived cost of carrying out protective behavior (response cost) was higher, the intent to take adaptive responses decreased (Prentice-Dunn & Rogers, 2001; Rogers et al., 1997).

Protection Motivation Theory has predominately been tested in instances of examining behavioral changes for personal health reasons (Floyd et al., 2000). For instance, a person may choose to live a healthy lifestyle (exercise and eat healthy), and the only person that it impacts is the individual that is living that lifestyle. In emergency management, Protection Motivation Theory has been utilized to help understand risk reducing behaviors during hazards. For example, PMT has aided in understanding why some locations that are flood-prone prepare and mitigate the risk of flooding and why other locations do not (Botzen et al., 2019; Bubeck et al., 2018). It has also been used to analyze motivation in response to tornado warnings (Evans, 2015).

The Protection Motivation Theory (PMT) will be a useful model when predicting if farmers have adopted levels of preparedness measures toward an agroterrorism attack. Protective Motivation Theory has traditionally been used in agricultural area, to explain adaptations made by farmers to combat issues such as climate change, droughts, flooding, earthquakes, renewable energy, and waste management (Badsar & Karami, 2020; Bagagnan et al., 2019; Feng, Huo, & Ma, 2017; Gebrehiwot & Van Der Veen, 2015; Jamnaimool, 2019; Regasa & Akirso, 2019). What is failed to be researched extensively is the theory of PMT and its application in understanding farmers’ preparedness for risks they deem most threatening. Protection Motivation Theory will be used to investigate farmers’ risk perception as well as their intent on implementing a defense or protection management plan in their line of work.

Both Bagagnan et al. (2019) and Badsar and Karami (2020) utilize Protection Motivation Theory to explain motivation toward utilizing renewable energy to help with climate change.
More specifically, their research wanted to reveal how crucial it is that farmers have practical information about the dangers of non-renewable energy, such as greenhouse gas emissions and global warming, and the potential cost benefit that renewable energy has to offer to their farm (Badsar and Karami, 2020). Their research found that response cost and reward were significant in motivating farmers to utilize renewable energy (Badsar and Karami, 2020). Their findings also revealed that the more knowledgeable the farmers were about renewable energy, the more likely they were to utilize the renewable energy tools (Badsar and Karami, 2020). Their research concluded that threat appraisal variables were positively correlated with motivating farmers to utilize renewable energy.

Bagagnan et al. (2019) researched how Protection Motivation Theory explains why farmers in Gambia chose to adopt climate change adaptation measures. The study used a transect walk guide and a semi-structured questionnaire. The questionnaire included a section on: perceived risk appraisal (the extreme weather evolving variables and plant growth factors), perception of coping (farmers’ perceiving their own ability to handle extreme weather events), and protection motivation (the farmers’ willingness to protect the farms against the extreme weather hazards). The questionnaire also examined response cost, stated preferences, perceived effectiveness, internal multipliers and barriers to pro-environment behavior, and some variables on socio-demographic and farm-specific variables. Risk appraisals were factored into a group named “Factors with Decreasing Effect” which included: heavy precipitation, duration of the growing season, and capacity of the soil water storage. Coping appraisal measures responsibility with items such as “government is responsible”, “consumers are responsible”, and “extension workers are responsible”. There was a positive correlation between farmers’ perception variables (decreasing effect variables of rainfall, soil water storage, etc.), vulnerability, and the farmers’ stated implementation of adaptation measure. Bagagnan et al. (2019) research found that risk appraisal and coping appraisal were positively correlated in increased farmers’
protection motivation, which further motivated to implement adaptation measures. Bagagnan et al. (2019) shared that farmers’ perception of climate change positively influenced their protection motivation. However, the cost of the adaptation measures were negatively impacting their effort of protection motivation (Bagagnan et al., 2019).

Gebrehiwot and Van Der Veen (2015) researched Ethiopian farmers’ cognitive perceptions of risk and behavioral intent to accept farm-level reduction measures. They structured a questionnaire based on Bockarjova et al. (2009) to suit drought risk with smallholder farmers being the unit of study. Key explanatory variables included: perceived vulnerability (how vulnerable did farmers feel to drought risk), perceived severity of drought consequences, perceived self-efficacy (perceptions on the effectiveness of a specific precaution), intrinsic reward, subject knowledge, age, education, household size, farm size, and livestock ownership. They examined the behavioral intent for a farmer to take risk-reducing measures as well as the farmers’ cognitive perception of risk (Gebrehiwot and Van Der Veen, 2015).

Utilizing a socio-psychological model of precautionary adaptation based on PMT and trans-theoretical stage model, Gebrehiwot and Van Der Veen (2015) sought to answer why some people will not show adaptive behaviors, while other will. Their research concluded that farmer’s behavioral intent to perform drought risk-reducing measures was statistically significant and showed positive correlation with protection motivation model variables. That is, “Vulnerability, severity of consequences, self-efficacy, and response efficacy lead to higher levels of behavioral intentions to undertake farm level risk-reduction measures” (Gebrehiwot and Van Der Veen, 2015, p.588).

Some of my interests included understanding farmers’ perceptions about potential risks that they believed to be most threatening their operation as well as their current mitigation activities.

Additionally, this research looked at how farmers received risk and mitigation information. Many
studies aim to research protection motivation as it pertains to farmers’ behaviors toward preparedness for climate change. I utilized Protection Motivation Theory to study behavior of farmers as it pertains to immanent risks threats impeding on Arkansas farmers’ farming operations. This research would aim to increase vigilance and create awareness about farmers’ perceptions and give a possible understanding about their preparedness. In addition, it may provide useful in standardizing and fostering more coordinated links between farmers, agencies, and policy makers to help better prepare farmers for any potential risks.

**Food Security**

The critical task of ensuring food security is one of the most exigent duties facing civilization (McDonagh, Farrell, and Conway, 2017). Food security is intrinsically focused on farming which means that food insecurity can stem from deprivation of farm production. Industrial agriculture serves as an apparatus for the exploitation of humans, because if a disease were invented, there is no better laboratory than agriculture related business to create havoc (Wise, 2019).

In 2020, one in every three people (nearly 2.4 billion) around the world did not have adequate access to food (United Nations, 2022). Despite being a developed country, the United States shows reports that about 11 percent of households experienced food insecurity in 2018 to 38 percent in 2020 (Wolfson and Leung, 2020). Across the United States, the prevalence of food insecurity in different states range from nearly 6 percent of homes to 15.3 percent of homes (USDA, 2022a). Arkansas’ prevalence of food insecurity ranks at about 10.7 percent (USDA, 2022a).

**Potential Causes of Food Scarcity**

Farmers are a critical component to aiding in the fight against potential food insecurity, but there are many challenges that farmers face that could potentially threaten their operations. These threats and risks have the potential to negatively impact the farms’ productivity as well as the
food availability. There are a multitude of challenges for a farmer that affects their ability to produce food and distribute it across the globe.

Climate change, Droughts, and Flooding

There is evidence that suggests climate change is a potential hazard to farmers’ operations. Unprecedented challenges to the everyday production and operations of a farm may be impacted by climate change (Chatrchyvan et al., 2017). Due to continuous anthropogenic activities, it is expected that by 2050 the average temperature will rise by 1.5 °C (Arora, 2019). Since the nineteenth century, the average temperature has risen by 0.9 °C (Arora, 2019). This anomalous spike in temperature has increased flooding, droughts, heat waves, abnormal patterns of precipitation, and other extreme weather related events (Arora, 2019). The weather threat on agriculture can be the real fear and be motivations for mitigation.

In the event of extreme droughts or flooding, under water and over water conditions, respectfully, have the potential to destroy crops (Rahman et al., 2017). Excessive water may lure in crops destroying pests and the water logging could decline crop yields (Motha, 2011). Hurricane Floyd in 1999 produced copious amounts of rain which led to flooding in North Carolina (Easterling et al., 2000). The storm runoff caused the flooding of sewage treatment facilities, farm waste lagoons, chemical storage facilities, and farms which caused the death of millions of farm animals (Easterling et al., 2000). Extreme heat may reduce the amount of milk production on dairy farms as the production is temperature sensitive and production drops if temperatures go beyond a certain threshold (Motha, 2011).

Extreme weather conditions can be costly to the agriculture industry. For example, after prolonged rainfall following Hurricane Sandy, Louisiana lost $110 billion in agriculture (Rahman et al., 2017). In 1988, the U.S. Midwest experienced extreme drought that resulted in crop yields dropping by roughly 37% and a $3 billion Congressional bailout to farmers (Wilhite et al., 2005).
Potential Disease and Outbreaks

Farm related diseases can be contracted and spread by animals on a cattle or poultry farming operation. There is a plethora of farm related diseases that have the potential to not only negatively impact farming operations and agriculture, but have significant consequences for people as well. The welfare of the animals is also at stake. Not only can disease cause physical ailments, but it can also disrupt their overall well-being. For example, parasitic infections or even pneumonia may cause severe pain and stress for the farm animals.

Some examples of diseases that could affect livestock include zoonotic diseases, such as avian influenza and Lyme disease, and livestock diseases such as foot-and mouth disease and bovine respiratory disease. Highly pathogenic avian influenza (HPAI), a virus transmitted from direct contacted with contaminated food, water, or exposure to excretions or secretions, was responsible for causing major economic losses in Asia, Africa, and Europe in the early 2000s (Koppinen, 2005; Webster et al., 2006; Dent et al., 2008; Fasina et al., 2008; and Fiebig et al., 2009). Rodents can cause major destruction to farm operations by contaminating feed and spreading various diseases amongst animals (Backhans & Fellström, 2012).

Smaller operations or backyard farmers may not be as knowledgeable about the risk of some diseases due to a lack of experience or lack of information or understanding (Nicholson, Campagnolo, Boktor, and Butler, 2020). For example, a study in Pennsylvania showed that small backyard farmers were less likely to take precautionary measures (biosecurity steps) when allowing visitors on their operation. Additionally, nearly 30 percent of those farmers reported never wearing gloves when handling the animals or manure (Nicholson, Campagnolo, Boktor, and Butler, 2020).

Supply Chain Disruptions
Food scarcity could be caused by a lack of supplies. Supply chain disruptions not only impact the export of farmers’ goods to the rest of the world, but it also reverberates through other aspects of their operation as well. Shipping delays can result in higher shipping costs, and it could potentially lead to rising input costs in items that farmers utilize daily such as fuel, fertilizers, and maintenance equipment.

Supply chain disruptions heavily impacted farmers during a widespread emergency. In response to the Covid-19 pandemic, government imposed isolation which in turn became problematic by creating a chain reaction of situations which led to shortage in supplies (O’Hara and Toussaint, 2021). For example, mandatory quarantines reduced the amount of employees that were able to work, which in a chain reaction led to production and work output to be reduced. This meant that there was a shortage of truck drivers and other labor availability. Labor shortages exacerbated shipping delays which ultimately resulted in congestion in places like shipping ports. Due to these shortages, shipments were forced to undergo delays because they did not have the labor to unload cargo ships which further delayed the import and export of agricultural goods.

Sri Lanka, at the time of writing this, is unfortunately experiencing a shortage of seed and fertilizer, which has led to crop yields shrinking to 50 percent this year (Sirimanne et al., 2022). In addition, Sri Lanka currently faces government imposed organic farming to be conducted by the nations nearly 2 million farmers, which was so catastrophic, it has led to a significant crop shortage and economic hardship (Nordhaus and Shah, 2022). Sri Lanka’s domestic rice production decreased by 20 percent, and they had to import nearly $450 million worth of rice (Nordhaus and Shah, 2022).

Extreme weather conditions can also contribute to a halt in the supply chain. Following Hurricane Katrina, damages along the Mississippi River caused a halt to the flow of agricultural trade and damages to the New Orleans caused halts and delays on international exports (Schnepf, R. D.,
An increase in global food prices and food scarcity can be attributed to the war in Ukraine (Domm, 2022). Due to sanctions and the war in Ukraine, there have been disruptions in shipments which have drastically increased the prices of fertilizer and grain (Domm, 2022).

**Agroterrorism**

We live in a world of heightened global terror, where nefarious intent to do violence to our agriculture and food is heightening (Hart et al., 2017; Seabra and Paiva, 2020). Terror might be generated by intentional infection of animals or plants via contamination of the animals’ feed and or direct insertion of toxic pathogens (Breeze, 2004; Wilson, Logan-Henfrey, Weller & Kellman, 2000). A viable target for a terrorist attack would be the agriculture sector. This type of terrorism is a subset of bioterrorism, known as agroterrorism. For the purpose of this research, I will utilize the definition of agroterrorism as defined by the United States Department of Agriculture Audit Report (2018) as, “the deliberate introduction of an animal or plant disease for the purpose of generating fear, causing economic loss, or undermining social stability”. This dissertation focuses on understanding farmers’ knowledge of current risk related info as well as their preparedness for risks.

Within the United States, there are a growing number of groups, such as Animal Liberation Front and Earth Liberation Front, which are capable of conducting an agroterrorism attack (Morris, 2007). There have been multiple documented instances of agroterrorism attacks. In 1952, a national liberation movement group in Kenya used local plant toxin, known as African milk bush, to poison 33 cattle at the British mission station (Riedel, 2004). In 1984, in an effort to keep voters away from election polls on Election Day, the Rajneeshee cult intentionally spread salmonella at Oregon restaurants, resulting in over 700 cases of salmonella poisoning (Tucker, 1999). The lingering effects of an agroterrorism attack might consist of loss of crops and
livestock, suffering animals, trade loss, and economic rippling effects that impact agriculture distributors, suppliers, restaurants, threat to the health of the public and more (Bhattacharjee, J., Bhattacharjee, D., & Samal, 2020; Riedel, 2004).

There are instances where terrorist attacks have been planned on our agricultural sector. In 2003, Senator Susan Collins testified, “hundreds of pages of U.S. agricultural documents recovered from the al Qaeda caves in Afghanistan early last year are a strong indication that terrorists recognize that our agriculture and food industry provides tempting targets”. Senator Collins (2003) goes on to state, “A CIA report released in May confirmed that the September 11 hijackers expressed interest in crop dusting aircraft, an effective and remarkably simple way to spread biological agents, including plant and animal diseases, over large areas.”

There are recorded incidents of the intentional introduction of a harmful toxin to animals. In World War II, over five million “cattle cakes” that were anthrax-infected were airdropped by the British onto cattle fields that belonged to the Germans ((Riedel, 2004; Rosie, 2001). In 1996, an unknown person (a supposed attacker) reported that feed products from a rendering plant were intentionally contaminated with the pesticide chlordane (Neher, 1999). The feed from this plant went on to negatively impact roughly 4,000 farmers in a four-state area (Neher, 1999). The major implications of this included contaminated milk being shipped to multiple dairy plants and nearly $250 million loss of product (Neher, 1999). In 2003, a nicotine-based insecticide was intentionally introduced into 250 pounds of beef by a resentful employee (CDC, 2003). The Centers for Disease Control and Prevention (2003) recorded nearly 100 individuals who became ill with symptoms including vomiting, burning of the mouth, and dizziness.

Predators

Predators such as wolves, foxes, coyotes, feral dogs, and wild hogs are concerns for livestock farmers. Animals with predator and carnivorous instincts typically target animals on farms like
cattle and poultry. Predation has accounted for major losses in livestock, and the loss of farm animals has rippling effects, such as significant negative economic hardships, to farmers across the United States. In the early 2000s, the U.S. Department of Agriculture reported that predators were the cause of losing nearly 200,000 head of cattle (USDA-NASS, 2006). This significant loss resulted in economic hardships for several cattle ranchers and overall had a monetary loss of almost $93 million (USDA-NASS, 2006; UMASS Extension, 2014).

In 2015, more than 40 percent of cattle deaths on farming operations were attributed to coyote attacks (USDA, 2017). Dog attacks accounted for approximately 11 percent of cattle deaths (USDA, 2017). Other unknown predators accounted for nearly 16 percent of deaths on farms (USDA, 2017). Wild hogs are notorious for causing mayhem and pose a serious threat to farmers and their agricultural operations (Seward, VerCauteren, Witmer, and Engeman, 2004; USDA, 2005). It is estimated that upwards of 9 million feral hogs disrupt and destroy farming operations annually. The destruction caused by these wild swine cost farmers approximately $1.5 to $2.5 billion in damages each year.

**Costs and Profitability**

Another potential threat to farmers is cost and profitability. Financial stability is important to a farmer so that they are able to continue farming on their operation. If a farm is unable to sustain and support itself financially, it is likely that the operation will have to discontinue operations and fold. Many factors go into ensuring that a farm can be sustainable financially. Input costs, product yield, market price fluctuation, machinery prices, fuel prices, and fertilizer and feed prices are just some of the fundamental components needed to ensure that a farm is able to operate while maintaining financial stability.

In the first six months of 2021, disruptions in shipping resulted in costing the United States dairy industry nearly $1 billion (Swanson, 2021). One farm in the United States lost $45 million per
month due to delays at shipping ports, resulting in cancelations and deferments in shipping (Swanson, 2021).

**Context and Background of Study Participants and Location**

**Location**

Arkansas is home to Wal-Mart, the largest food retailer globally, and Tyson (one of the largest poultry producers within the US), which is one reason I have chosen to focus on Arkansas farmers to be included in this study. Globally, Tyson ranks second in processing and marketing of chicken, beef, and pork (Noe and Musunuru, 2020).

In 2017, it was projected that a major threat, such as an agroterrorism attack or weather related disaster, on livestock alone would cost anywhere between 10-30 billion USD in damages to the United States economy (Alekseeva et al., 2017). The state of Arkansas would have several farmers, land, livestock, and crops that could be impacted. The 2020 State Agriculture Overview Report shows that there are 14 million acres of operational farmland in Arkansas (USDA and NASS, 2021).

Nationally, Arkansas ranks 2nd for the production of chicken and broiler meat and 10th for the production of beef cows (Arkansas Department of Agriculture, 2021). All cattle and calves in Arkansas totaled 1.76 million head (USDA, 2017).

Arkansas is consistently ranked in the top third of the country for agricultural cash farm receipts, and in 2017 had $8.9 billion in agricultural cash receipts (USDA ERS, 2019a). As of 2017, Arkansas has 42,600 farms (USDA NASS, 2019a). One out of every six jobs in Arkansas is agricultural related (Implan, 2018).

**Farmers**
The target population includes Arkansas farmers, that are specifically poultry farmers and cattle ranchers. The poultry farms could include breeder farms, broiler farms, and pullet farms. Arkansas has over 2,400 broiler farms and over 27,000 farms raise cattle (USDA 2020; USDA 2022). The typical beef cattle herd size in Arkansas consists of 35 head, and 80 percent of the farms having less than 50 head (University of Arkansas Division of Agriculture, 2022). In Arkansas, nearly 97 percent of the beef cattle farms are family owned and operated (University of Arkansas- Division of Agriculture, 2022).

The aims of this study are to examine how Arkansas farmers understand risks to their farming operations and how they make decisions about hazard adjustment and mitigation activities while utilizing Protection Motivation Theory as the theoretical lens. While reviewing existing literature, it became clear there were gaps in research using Protection Motivation Theory. Throughout the review, it was apparent that this theory focused on individuals and households. There are limited studies using PMT in agricultural related research. Most literature using this theory often limits their scope to focus on one particular risk.

Research Questions

Based on the theoretical lens of Protection Motivation Theory, research questions were developed focusing on Arkansas cattle and poultry farmers. This qualitative study looked to gain an understanding of farmers’ perspectives about risks to their operation as well as their motivations to pursue mitigation activities to help protect food security. This study aimed to answer the following research questions:

*R1: What do Arkansas cattle and poultry farmers view as the biggest risk factors to food security?*

*R2: What motivates Arkansas cattle and poultry farmers to take protective motivation action to ensure food security?*
R3: Where do Arkansas cattle and poultry farmers receive information about risks and mitigation activities?

The next chapter of this dissertation explores the methodology. It will cover the aspects of philosophical paradigm and justify the methodological decisions that were implemented in this research. It will outline the specific approach, method selection, data collection, and analysis.
CHAPTER III

METHODOLOGY

This is a qualitative, deductive, pragmatic study using Protection Motivation Theory as a lens, critically examines Arkansas farmers’ understanding of risks, their mitigation activities, and their information seeking behavior. This chapter details the methodology used to gather data from farmers in Arkansas and conducts content analysis on the resulting data using Protection Motivation Theory as a framework. Based on this theoretical framework, this chapter will critically examine the specific philosophy utilized, the process of data collection, data analysis method, and ethical considerations. Using pragmatism as the guiding philosophical paradigm, interviews were conducted with Arkansas cattle and poultry farmers.

Philosophical Paradigm

A research paradigm refers to a philosophical framework. Paradigmatic beliefs are influential and can often be the grounds for why a researcher selects a particular method for their research. Paradigms encompass conceptual and practical tools that can aid in researching specific questions. This research was grounded in the philosophical paradigm of pragmatism.
Pragmatism bridges theory and practice, accentuating practical usefulness in the real-world while also possessing adaptability. Some researchers define pragmatism as taking on the role of both an epistemology and ontology because it implies a flexible form of social ontology (Frankel Pratt, 2016; Hothersall, 2019). Peirce (1905) defined the philosophical paradigm of pragmatism as a critical common-sensism. Pragmatism served as a starting point for evaluating theories in order to determine whether or not they were based exclusively on a foundation of non-inferential knowledge or belief. Pragmatists act on the foundational basis of what is assumed to be anticipated consequences (Pierce, 1905). Pragmatism is about what you do and why you do it while taking practicality into account (Pierce, 1905; James, 2001).

Pragmatism was the strong epistemological component driving this research. However, critical realism also helped shape the methods and analysis. Critical realism highlights theory first while shifting the central focus toward recognizing the mechanisms that aid in explaining “why” things happen (Bhaskar, 2020; Vincent and O’Mahoney, 2018). Critical realist ontology also emphasizes the questions of, “What is” rather than, “How can we know” (Vincent and O'Mahoney, 2018). Critical realism suggests that knowledge is conditioned by and reliant on history, develops through critical assessment, but it is restrictively bound by history, society, and politics (Fletcher 2017). Combining the paradigms offered an approach that bridges theory, empirical data, and practicality to aid in a foundation that was suitable for this particular research.

With the outline of a pragmatist approach set within critical realist ontology, it became apparent that, due to the exploratory nature of this research, there would be a need for a research design that would account for the collection of rich text. A qualitative research design was a better fit for this research because of its capability of surfacing emerging themes without limiting the research results to just a number (McAleavy., Dement, and Murphy, 2024). It would help bring to the surface rich themes and represent deeper meanings behind the texts. The goals of this study were to see how farmers viewed threats to their operation, where they received information about the
threats and potential mitigation activities, and their intent to adopt measures to protect themselves from the perceived risk.

**Data Collection**

This exploratory, qualitative study focused on understanding what Arkansas farmers viewed as a threat to their operation, how they obtained information about the risk or threat, how they mitigated, whether or not they received information about said risk, and where they received information about the risk or mitigation steps. The interview questions were intended to probe specific concepts in Protection Motivation Theory. It is more common for researchers using Protection Motivation Theory to utilize a survey method for their research. However, Protection Motivation Theory has been most commonly applied to individual or household level analysis. There is not a foundation of knowledge about risk perception in the farming community that would lead to the construction of a validated survey instrument. Instead, in order to help identify important variables, this study utilizes semi-structured qualitative interview questions and analysis research design. This dissertation is intended as a foundation for future studies and to expand our understanding of Protection Motivation Theory when it is applied to farming operations.

**Study Participants**

Agriculture in Arkansas is primarily known for its poultry and cattle; therefore, the study focuses on those particular types of farmers. Purposive snowball sampling was used to identify farmers that fit the following criteria: (1) located in Arkansas and (2) a farmer specifically dealing with poultry, cattle, or both. While the Arkansas agricultural realm is tightly interwoven with the chicken company Tyson, I chose to exclude those farms in this study. One practical consideration I chose to omit Tyson farms was because accessibility to these particular farms may be challenging for legal reasons. While there is no guarantee that there may have been a lack of
transparency by these farming operations, I felt that excluding these farmers would be best to help ensure that there was no bias or reluctance to share information that might hurt their relationship with Tyson during the interview process.

An exponential non-discriminative snowball approach was utilized to reach additional respondents. The first interview conducted was with a farmer that through mutual connections, was known to meet the farming criteria needed for this study. I reached out to this farmer, and they were enthusiastic to participate in this study. Following the interview, I followed up with a question that asked if there was anyone else they thought would be beneficial to speak with about this particular topic. Additional respondents were contacted via phone call in accordance with the research plan approved by the Oklahoma State University Institutional Review Board. A total of 28 interviews were conducted. Rather early in the interview process, it was apparent that answers were similar on many overarching themes, but I continued the interview process until it was clear that thematic saturation was achieved. All of the interviews were recorded, transcribed, and analyzed, which will be explained in the following sections of this chapter.

It is important to point out that Institutional Review Board (IRB) clearance was required before any of the interview process could be completed. Following the completion of the IRB application and its approval, a consent form (Appendix B) was utilized for each participant. Verbal consent of these interviews was acquired prior to each interview. Each interview lasted no longer than one hour. Participants were informed that they would be recorded. In addition, participants were also informed that they may opt out of any recordings or the participation of the study at any time. Interviewees were also aware that their name would remain anonymous and that all of the information was used for research purposes. If they had any questions, I also provided the farmers with a way to contact IRB.

*Interview methods: Audio Calls and Recordings*
The interview portion of this study was conducted from April 2023 until June 2023. The methods of contact utilized were phone calls and Zoom interviews. These particular methods were chosen because they offered flexibility and convenience. Each interview session varied in length based on how much information each participant shared. Recording the interview sessions was beneficial, because it was a great tool to ensure that data was captured accurately. The Zoom recordings were a bit simpler to transcribe as they utilize built-in software (Otter) which transcribes the interviews immediately following the Zoom meeting. An additional audio recorder was placed next to the computer speakers to be utilized as a backup recording in the event that something happened to the recordings on the computer. For the interviews that were conducted via phone call, the recordings were also uploaded and transcribed by the same software as the Zoom meeting calls. The transcription software was able to transcribe the interviews with high accuracy. There were some instances in which the software had a difficult time transcribing the southern accent. I listened to the recordings while following along with the text. I corrected any discrepancies I found in the transcript.

This study was deductive in nature. Protection Motivation Theory was utilized as a guide for the development of questions and coding in this research. Protection Motivation Theory aims to understand adaptive and maladaptive coping responses to perceived threats, and it has two components: threat appraisal and coping appraisal (Rogers, 1975). Questions were developed with threat appraisal and coping appraisal as a guide. Threat appraisal questions were created in a way to probe the constructs of severity, vulnerability, and rewards. Coping appraisal looked to uncover response efficacy and self-efficacy. To understand what farmers found to be a risk or threat to their operation question 2: “What do you view as the biggest risk to your operation?” was asked. Fear appeals and vulnerability were based on questions 2a, 2b, 2c, 2d, and 2e which outline why a farmer was concerned about a risk, and whether or not they had obtained information about the risk of concern. Mitigation options were found asked in components of
questions 3 and 4. These questions critically examine what steps farmers take to protect themselves. Self-efficacy and ability to take protective measures were analyzed from components question 3 which asks whether or not a farmer has taken steps to mitigate or protect themselves from a risk. Intention and adoption questions came from 3b. Further explanation on the deductive coding can be found in the coding section below.

Measures

Questions were developed using Ronald Rogers’ (1975) Protection Motivation Theory. With the aid of my advisor, committee, and previously existing literature, questions were created that were intended to probe specific concepts that were appropriate in the context of Protection Motivation Theory. More specifically, the questions were presented in a way that displayed the threat appraisals and coping appraisal of Protection Motivation Theory. The threat appraisal questions examined which threats were most likely to affect the farm and how likely the farmers believed those perceived threats were to impact their operation. The coping appraisal questions were intended to explore self-efficacy, response efficacy, and response cost. The questions utilized in this research can be found in appendix A.

Analysis

Transcription

Preliminary transcription was completed utilizing the Otter software that is already embedded within Zoom. Following an interview via Zoom, transcription would begin automatically following the interview. The process of conversion from audio to text varied depending on the length of the interview process, but on average it usually took around 25 minutes to convert an interview that was no longer than an hour. Phone interviews utilized the same process, but sometimes could take a few minutes longer to complete. Southern accents can be challenging for software to convert audio to text with complete accuracy. Otter software allows the reviewer of
the transcript to be able to follow along with text so that corrections could be completed along the way. Once all of the corrections were completed, the file was exported to a text file, I moved the text to a Microsoft Word document, and saved it to a drive. Reading through these files started the process of theme development and coding.

Coding

Coding is the process of assigning labels to the text from the transcripts in an effort to organize data to help a researcher identify themes and patterns (Qureshi and Ünlü, 2020). This study was deductive in nature and therefore coding started with a predefined set of codes as outlined by Protection Motivation Theory. The two major components within Protection Motivation Theory that were utilized were threat appraisal and coping appraisal. An analytic process was utilized to first critically examine interviews for qualitative data analysis. Coding was based on protection motivation variables. The first level of coding included open coding, which involved analyzing data to find thematic domains that fit within the two components of Protection Motivation Theory. The transcripts were then looked over to find related Protection Motivation Theory constructs (severity, vulnerability, rewards, response efficacy, and self-efficacy). Broad themes were developed by analyzing interviews to look for words that were common in subject as it relates to Protection Motivation Theory. I first looked to analyze emerging risk themes of weather, disease and illness, predators, money, and an additional category for miscellaneous terms.

After interviewing six farmers, the aforementioned emerging themes were already becoming apparent, but as I progressed through the rest of the interviews it solidified the open code themes. Examples of broad words that were later developed in axial coding to become themes included terminology such as drought, sickness, input costs, market, tornadoes, feed prices, heat, disease, and predators. Suggested thematic directionality was discussed with my committee chair. With
guidance, the themes were created from the open coding to create more concise code categories, and they were further broken down to encompass subcategories. The responses from the interviews were qualitatively analyzed to categorize emerging themes for coding. These themes included weather, monetary influences, diseases and illness, predators, and other. Within these themes were additional subcategories. The figure below will display these categories and subcategories that were created based on the qualitative analysis of the interviews. These categories and subcategories will be discussed in detail later on in the analysis chapter. Manual coding was utilized. Each transcript was initially reviewed for the broad themes, as discussed previously. I then went through each transcript highlighting each theme, words, and quotations by certain color schemes so they could easily be recognized. I created a table that represented the themes, codes, and categories as outlined in Table 1 and Table 2 below.

<table>
<thead>
<tr>
<th>Perceived Hazards and Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cost</strong></td>
</tr>
<tr>
<td>---------------------------------</td>
</tr>
<tr>
<td>Input (feed, upkeep)</td>
</tr>
<tr>
<td>Market</td>
</tr>
<tr>
<td>Increase feed price</td>
</tr>
<tr>
<td>Cattle prices</td>
</tr>
<tr>
<td>Flood (too much rain)</td>
</tr>
<tr>
<td>Lightning</td>
</tr>
<tr>
<td>wildfires</td>
</tr>
<tr>
<td>Extreme temperatures (hot/cold)</td>
</tr>
</tbody>
</table>

Table 1: Perceived Hazards and Risks
Table 2: Mitigation Activities

<table>
<thead>
<tr>
<th>Cost</th>
<th>Weather</th>
<th>Disease/Illness</th>
<th>Predator</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stock up on feed</td>
<td>Irrigation pond</td>
<td>Vaccine</td>
<td>Trap</td>
<td>Speaking with elected officials</td>
</tr>
<tr>
<td>Keep eye on market to lock in prices</td>
<td>Create barriers/wind blocks</td>
<td>Isolate animals</td>
<td>Educate people</td>
<td>Stock up on supply</td>
</tr>
<tr>
<td>Plant own feed</td>
<td>Do Nothing/acts of God</td>
<td>Shelter/put animals away</td>
<td>No trespassing sign</td>
<td>Educate the public</td>
</tr>
<tr>
<td></td>
<td>Place gravel to prevent sliding</td>
<td>Vet checks</td>
<td>Guard animals</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Insurance</td>
<td>Insurance</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Euthanize</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Ethical concerns

Precautionary measures were utilized in an effort to protect all of the farmers that participated within this study. A major component of ensuring that participants would be free of ethical dilemmas was to send the proposed research to the Oklahoma State University IRB to be reviewed. Due to the way that data was collected, human participants were not considered to be at risk. Confidentiality was a key concern, so it was important that each participant understood that their name would remain anonymous as their name would be replaced with a coded pseudonym.

As previously mentioned, all consent forms which were provided to the participants were reviewed and approved by the Oklahoma State University Institutional Review Board prior to any
research. All of these documents submitted to them can be found in the appendices section. Each participant provided verbal consent prior to their interview.

As with any discussion of risk, farmers may have had a previous experience with an event related to the risk discussed, which may have triggered stress. To ensure that the interviewees were not feeling nervous or stressed, each participant was informed that they could choose not to answer and stop the interview at any time. During this interview process, none of the farmers vocalized being stressed or uncomfortable, and all of them completed the interview process.

The subsequent chapter of this dissertation explores the research findings. The findings chapter will serve to discuss the results obtained from our qualitative analysis. It will focus on finding themes and patterns that emerged from the interview data collected as well as highlighting farmers’ risk perceptions, mitigation activities, and means of information seeking.
CHAPTER IV

FINDINGS

The findings are drawn from the content analysis of the qualitative data collected from interviews with Arkansas cattle ranchers and poultry farmers. Narratives from Arkansas farmers were examined using Protection Motivation Theory to explain cognitive processes related to risk and mitigation on farms. Specifically, this study is focused on threat appraisals, coping appraisals, and information sources in order to better understand how farmers and ranchers perceive risks to their operations and make choices to engage in mitigation activities.

Interviews were conducted with Arkansas farmers and ranchers who handle poultry or cattle. Due to the exploratory nature of the study, interviews were conducted in a way that allowed for open-ended responses and discussion. Throughout this section, there are multiple quotes italicized that were chosen because the quotation best summarized or encompassed a theme shared amongst respondents. The responses from the interviews were qualitatively examined to identify emerging themes for coding.

While the overarching theme for this study encompasses identifying perceived threats and how of farmers are protecting their operations from hazards that could negatively impact food security, there were findings within this research that will be noted and could be expanded upon at a later
time. In this chapter you will find a discussion of themes related to Protection Motivation Theory along with information from the interviews that support the themes. Below is a graphical representation of the structure that PMT follows.

![Graphical representation of Protection Motivation Theory from Research by Alhamad and Donyai (2021)](image)

**Figure 1: Graphical representation of Protection Motivation Theory from Research by Alhamad and Donyai (2021)**

**Threat Appraisals**

Threat appraisal captures the subjective interpretations of particular hazards Arkansas farmers’ view as most ‘threatening’ to their operation. Upon examination of the narratives of Arkansas farmers’, threat appraisals were identified through open-ended questions that were exploratory in nature. Interviews were examined for terminology (as outlined in the coding section) that could be categorized into codes encompassing common themes. Within Protection Motivation Theory, threat appraisals encompass components of perceived severity of the threat, the perceived threat vulnerability, fear appeals, response cost, and self-efficacy (Rogers, 1975;1983 and Rogers and Prentice-Dunn,1997).

For this study, the term ‘threat appraisal’ is when an individual (farmer) assesses their vulnerability to a hazard (threat vulnerability) and the perceptions regarding the extent of damage or harm (threat severity) (Rogers, 1975;1983 and Rogers and Prentice-Dunn,1997). Perceived threats were identified utilizing interview question 2: What do you view as the biggest risk to
your operation? These themes included weather and climate events, monetary pressures, disease and illness, predators, and ‘other’ or miscellaneous.

**Weather and Climate Events**

Throughout the interview process, it was expressed by many farmers that agricultural success is highly dependent on appropriate weather and climate conditions. Environmental conditions affect many components in agriculture ranging from uneven terrain, extreme climate conditions, and animals’ abilities to access water (Nyoni, Grab, and Archer, 2019; Holechek, Geli, Cibils, and Sawalhah, 2020). Extreme fluctuations in temperature can hinder farmers from planting crops necessary to feed animals. Insufficient rainfall or dry conditions present numerous challenges for water availability such as irrigation challenges. Furthermore, water scarcity impacts animals by reducing accessibility to adequate drinking water. Throughout the study, weather and weather related terminology was cited more than any other mentioned hazard. A majority of farmers mentioned weather or climate related events as being a potential threat to their farming operation.

“I mean, weather most of the time (in terms of biggest risk). It really doesn’t matter what you’re doing in agriculture, weather will be a burden.” *(R11)*

Fluctuation in temperature was also a risk mentioned by farmers. When seasons change, it could alter a farmer's growing season. A warmer season occurring earlier than expected can influence unwanted pests and diseases to show up on farming operations. Furthermore, unexpected heat waves have the potential to harm a farm animal’s health. Animals on the farms having weather related health issues may experience unnecessary weight gain or a significant reduction in milk or egg production (Mbuthia, Mayer, and Reinsch, 2021; Mylostvyyi, 2021; Soliman and Safwat, 2020). Alternatively, shifts in frost time can stress animals.
“In the winter it is too cold, which is tough for chickens and cattle, but in the summer whenever we get 100 degree weather or higher that is also stressful to our animals, so our biggest concern is keeping them comfortable.” (R17)

The types of weather hazards mentioned were varied. However, common themes were brought to attention in terms of weather. These themes included: dry vs. wet, extreme temperatures, weather events, and wind.

Dry Conditions vs. Wet Conditions

Arkansas cattle and poultry farmers articulated concerns when it came to unfavorable amounts of water or lack of water on their operation. It was expressed by the respondents that an excessive amount of water could lead to sluggish terrain conditions for their farm animals. These conditions would make it difficult for animals to walk through, potentially causing them to injure themselves. Additionally, many farmers stated concerns of not being able to plant crops that their animals consume due to rain damaging the soil conditions. Alternatively, a lack of rain may result in crops not germinating properly, ultimately obstructing crop production.

“If it is too wet from the rain, the grass doesn’t grow, if it’s too dry from the lack of rain, the grass doesn’t grow, which means hay doesn’t grow” (R8)

Insufficient crops indicate that farmers have to figure out how to feed their cattle from sources beyond what is produced exclusively on their operation. If they are unable to provide food for the animals on their farm, farmers must rely on outsourcing by purchasing feed. The expense of the feed purchased would then cut into a farmer’s profit margins. This causes a rippling chain reaction that if farmers’ profits are negatively affected, then fewer products are being produced, demand increases, and ultimately leads to a price increase for consumers.
Extreme drought conditions were mentioned predominantly in the interviews. Droughts were viewed negatively because they inhibit the growth of crops that are utilized to feed animals on the operation. While there was a concern that animals were not going to be adequately fed based on food grown on the farm alone, it should be noted that farmers seemed to be more concerned about the lack of feed production because that would mean they would have to outsource the food supply which meant more expenditures and less profitability.

“We had a really terrible drought. So, that was very difficult because, you know, we’re limited on the amount of hay that we had and limits on what we could feed to the animals” (R21)

“The last couple of years there have been pretty severe droughts …. that forced a lot of people to sell [cattle] because they just didn’t have feed for their animals, so they had to sell off a lot of their cattle...this led to a nationwide shortage” (R16)

**Extreme Temperatures**

Temperatures that ranged from excessive heat to excessive cold were mentioned throughout the interviews. Exposure to one extreme or the other negatively affects farm animals and the crops that feed them. Much like the flooding or excessive arid conditions, extreme temperatures impacted crops grown that aid in feeding poultry and cattle.

“We had an extremely cool spring and the grass needed to be growing. It was too cold at night for the grass to be growing when it normally would have been growing.” (R14)

The main concern when it came to temperatures was being able to keep the cattle and poultry comfortable during the periods of excessive heat or cold. Temperature related stress concerned farmers because animals may suffer from heat exhaustion or extreme cold. Both of these instances could result in poultry not producing eggs, cattle not feeding properly, or in extreme cases death of these farm animals. This affects food security because there is no product or a limited supply of the product for a farmer to sell. If there is not a sufficient quantity of product for
the farmer to sell, then there is little to no profitability. Without profit, these impoverished farmers are subjected to extreme measures such as letting go farmhands or shutting down their operation entirely. Now families that worked the farming operation don’t have an income.

“We had to put a lot of stuff up to buy cattle. It could have cost me everything.” (R19)

“The cows get skinny if there isn’t food and it’s harder on their bodies and it's harder for breeding purposes” (R4)

This shortfall in supply of poultry or cattle would also increase prices for the consumers. For families that no longer work on the farm, the recent loss in income may prevent them from being able to purchase the newly skyrocketed prices of food. Farmers would also suffer from increased prices on supplies such as animal feed.

**Disease and Injury**

Diseases can spread quickly on farms and ranches because of the multitude of pathways that they can be spread. Infected animals contacting other animals, unintentional cross contamination through animal feed, disease carrying insects biting a farm animal, and soil contamination are just some of the methods that a disease can quickly creep into and engulf a farming operation (Dash, Dipankar, Burange, Rouse, and Sarangi, 2021). It should be noted that farmers that voiced concerns of disease also often paired the threat with monetary concerns.

“So with disease, you run the risk of it spreading. Which means it can impact the rest of the cows. You can’t sell sick cows. Or worse they die and you are out of making money for that cow.” (R8)

Poultry farmers also discussed their vulnerabilities when it came to keeping their birds free from potential disease. For poultry farmers, there were concerns of wild birds carrying disease landing near their poultry or on their farming operation. Just like many of the cattle ranchers, the poultry farmers feared that if their birds became ill from disease, the poultry would die. This would
ultimately result in the poultry farm not generating revenue, and the lack of income would ultimately force operations to shut down.

“If my birds die from wild birds (bringing disease or virus), then that eliminates my whole poultry operation. Without the poultry, there is no operation, and therefore no selling or profitability.” (R9)

Unlike cattle farmers, poultry farmers are not able to just isolate the one sick bird. Because of how close the poultry is kept in proximity to another, multiple birds would unfortunately have to be euthanized if they were exposed to disease.

“We have to get rid of all of our sustainability. As far as the chickens go, we would have to kill off all of them. We would have to start over from scratch. Rebuilding. That's time, money, and resources” (R10)

**Predators**

While the responses from farmers did not primarily focus on predatory threats, there were a few farmers that did organically bring the topic up in interviews as a likely impending threat to their farming operation.

“We do have a little bit of trouble with predators. Coyotes and buzzards. And I will say I guess the other thing that was affecting this to a certain degree is wild hog population. They are starting to be detrimental to grazing pastors. And eating hay bales. Really hurts you more than the grazing.” (R7)

A predator to a farm was most commonly perceived as an animal of the wild, such as coyotes and wild hogs. However, some farmers also pointed out that humans can be a predator to their operation.
“There sure weren't subdivisions popping up around where we live....now we run the risk of uneducated people taking it upon themselves to come into our pastures and interfering with what we worked on... basically, humans are predators.” (R15)

People unknowingly may cause harm to animals. One farmer indicated that a baby calf was lost due to a lack of understanding of how farming works. An instance arose where a baby calf was close to a fence line that could be seen from the road. To a person not familiar with raising cattle, it may have appeared that the cow was thirsty and all alone. A person driving by stopped and hopped the fence in an attempt to give the calf water. Unfortunately, because of the person not understanding how raising a calf works, they unintentionally caused a disruption in which the mother cow no longer wanted to care for calf. The farmer discussed how people sometimes think, from the outside looking in, that they are helping, when in fact it is the exact opposite.

“We had enough ‘no trespassing signs’ up..... They actually called law enforcement to report it, and they were advised that it's private property. Stay out, leave it alone. Nature will take care of it, you know, and regardless of the warning they got, they got a gallon bucket and some water and a turkey baster and they went and drenched our newborn calf ....the calf died.” (R15)

**Other Perceived Threats**

While a majority of farmers did not mention these particular threats, it should be noted some of these threats may be of interest to researchers for further exploration. Suburbanization was a concern mentioned. Suburbanization not only leads to the construction of buildings and homes, it always leads to a loss of farmland (Semuels, 2019). Farmers that are not able to sustain their farming operation and are struggling, sell their land to developers (Semuels, 2019). People living in areas without farm land may not realize what goes into a farming operation.
“People in general don’t have information about farming or an understanding about it. You know, that’s a risk. Because more and more people don’t live in the country, they live in cities, they don’t understand exactly where food comes from” (R1)

Political influences and government involvement were also expressed as concerns. Farmers did not have specific topics about political influence, but stood firm when it came to their opinion on whether or not their farms should have government involvement. Some farmers believed that government did more harm than good, and wanted little as possible involvement. However, some farmers extended an amount of appreciation for some economic relief provided by the government during financial hardships.

“I need less government involvement than before…..it just ends up costing us [farmers] more in the long run.” (R15)

The shift to meat alternatives was also perceived as a potential risk. Technological innovations have led to the creation of meat alternatives while simultaneously displacing farmers (Semuels, 2019). Over the years, the consumption and manufacturing of meat has alarmed researchers about environmental sustainability, a considerable reduction in biodiversity, and rippling effects of pollutants such as greenhouse gases (Steinfeld, 2006; Machovina, Feeley, and Ripple, 2015; Van der Weele et al., 2019). One respondent even discussed the difficulties that they faced with dealing with entities that regulate tasks performed on their operation to ensure that everything on their operation followed their guidelines to their satisfaction.

“Like with EPA, the air quality, the water, and the soil, you know, they had like all these regulations. Even like carbon tax stuff. I still think it is a risk. It could lead to financial problems.” (R1)

This shift has led to altering the way we think of food and the widespread development of meat alternatives (Van der Weele et al., 2019). Advancements in technology that led to the expansion
of meat alternatives made some of the farmers that were interviewed feel as though they were being replaced. Additionally, many farmers voiced how people today just don’t entirely understand the process of farming and what all it entails.

“Because more and more people don’t live in the country, they live in cities they don’t understand exactly where food comes from” (R1)

The farmers interviewed voiced frustration that technology was replacing the jobs and farm duties that the farmers were usually tasked with completing. When the farmers are no longer needed, they lose their jobs, the farm land, and often times their farm home that had been in their family for multiple generations (Semuels, 2019).

“I truly believe, and I don’t know if it’s going to be 100 years from now or 500 years from now, but people won’t eat meat anymore…..That’s a big risk too, you know, when it comes to the livestock producers is that people are turning to meat alternatives… It could lead to financial problems… There’s always the chance of slowing meat production.” (R1)

Rarely mentioned, but still brought up was how supply chain was a potential threat to a farming operation. One example provided an instance during the Covid-19 pandemic in which supplies for their operation were impacted. They felt an increased pressure to try and keep their animals alive while operating with limited funds.

“COVID-19 proved that it [supply chains] can be fragile. It scares me that something like that could happen again. I was almost close to running out [of feed and farming supplies] before and had to be creative.”(R9)

**Monetary Pressures**

In the end, the biggest threat to farms is monetary pressures, which is really a consequence of all the hazards mentioned by the respondents. The continuation of farming weighs heavily on being
financially stable. Unfortunately, farmers are faced with the pressures of rising input costs, growing interest rates, and the volatility of the farming market (Vidhya, 2021; McDonald and Holtz, 2020; Burchfield, Schumacher, Spangler, and Rissing, 2020). Projected net farm profits for the 2023 calendar year are forecasted at approximately 16 percent decrease compared to 2022 (USDA, 2023).

There are many causes of financial distress in farming and ranching. Arkansas farmers expressed concerns with profitability due to large money expenditures for basic upkeep to their farm. More specifically, input costs for items such as feed and fertilizer were mentioned. Higher prices for input costs makes transitioning farms from one generation to the next more challenging if the financial stability is no longer applicable to the farming operation.

“The price increases [are perceived as the biggest threat to the operation]. You know, it seems like every day the price of feed goes up. Eventually, it is going to get so high, that farmers won’t be able to keep going. It’ll make us become fewer and fewer.” (R23)

“The biggest risk is probably losing money and not making any. It just costs a lot to maintain and keep up with. Then, if you go to sell them [cattle] it [farming operation] may or may not break even.” (R19)

A farmer’s financial stability and sustainability of agriculture is based primarily on farm productivity, environmental stewardship, and the monetary profits (USDA-NIFA, 2023). Financial pressures also worry Arkansas farmers due to the fluctuating market value of their farm assets.

“I guess cattle prices [when asked the biggest risk] because you just you don’t really have any control over that, you know everything is expensive and when you sell at market it may not be what you wanted for them. You’re kind of at the mercy of whatever the market is doing at the top.” (R21)
Based on a report by the Centers for Disease Control and Prevention (CDC, 2017), suicide is committed by ranchers and farmers at three times the national rate. This is because of burdening financial stressors such as plunging sale prices, increasing input cost, increased debt, and weather conditions that make it tough to farm (Wedell, Sherman, and Chadde, 2020; Miller and Rudolphi, 2022).

Farm loan delinquencies are continuously on the rise (Semuels, 2019). Between 2011 and 2018 more than 100,000 farms have been lost due to inadequate means of funding, and knowing that not even reorganizing through bankruptcy could save the farm (Semuels, 2019). Consequently, this means farms are shutting down leading to a cascade of events that lead to food insecurity.

**Information Sources**

An asset for aiding farmers with risk management is obtaining information. A plethora of information sources are available to farmers that aid in helping them better understand potential risks to their operation. The uptake of information could be from official sources such as extension services or government websites and unofficial sources such as friends or social media. When the farmers were asked if they had ever received information about a particular hazard being a risk, there were a few common elements to their answers. First and most commonly, farmers indicated that they had not received information from official sources about the risk they perceived as the biggest threat to their operation. Alternatively, the majority of respondents that did hear about the biggest risk would often rely on hearsay or guidance from relatives or friends in the same farming industry. Farmers that did recognize a particular source would refer to obtaining information from social media, emails, or magazines.

**Official Sources**

Farmers may look to official information sources when it comes to making decisions about things that affect their farming operations. Farmers have accessibility to a range of official resources that
have key information that would be useful to help improve their risk management practices. An example of an official source may be the United States Department of Agriculture, Food and Agriculture Organization, or even extension services (USDA-RMA, 2024; FAO, 2024, UADA, 2023).

“*You could look on websites like the EPA or Department of Agriculture*” (R1)

“*You know, the University of Arkansas extension service has had some [information about risk management] and then the Department of Agriculture offers updates. If anything is going around they send out notices. *” (R8)

Many farmers look for guidance from official sources to help them better prepare for risks that could profoundly impact their operation. For questions about the health of their animals, farmers may turn to their veterinarian for guidance about information relating to the animals such as upcoming vaccines (Cresswell et al., 2013).

“I have a relationship with a local vet that also keeps me up to date on what is going around and stuff” (R8)

*Unofficial Sources*

Not all of the farmers strictly looked for empirical evidence or relied on certified official resources as a means of obtaining information about potential threats to their operation. Farmers seemed to be more receptive and reliant on information provided by individuals that they felt they could trust for information. Social norms amongst the farming community were shared amongst fellow farmers and played a role in informing farmers about potential threats and motivated farmers to take protective action. For example, some respondents stated they would obtain risk related information from family or fellow farmers that they had known for years. Some farmers even looked to social media platforms such as Facebook as a way to join online groups to discuss
potential threats and concerns. While this method does not typically go under rigorous peer review, it may provide to be a quick and efficient way of relaying information from one farmer to another.

“TikTok videos about how you can grow mill worms and such on your own. Yeah, I know such a credible source, right? But also Facebook groups helped inform me on things I could substitute for feed and what not.” (R9)

“Social media pages like Arkansas Poultry and like Arkansas Cattle and things like that. You could go and look at the comment boards….that's where I found a lot of information” (R4)

**Age and Other Demographics**

Equitable representation across gender lines were blurred as most respondents were male. Furthermore, most respondents were over the age of 40. It should also be noted that while the primary focus of this study was not directly identifying how age influences how a farmer obtains information, it was apparent that the younger generation of farmers were more reliant on technology, while the older generations relied on in-person communication. Schnitkey et al. (1992) recognized that age and farming experience are correlated, and that the more experience a farmer received the less likely they were to demand information from external sources. Acquiring new information is less sought-after by older aged farmers compared to younger aged farmers (Schnitkey et al., 1992; Ngathou et al., 2006). Throughout the interview process, it was apparent that younger farmers were more receptive to obtaining new information. Preferred methods of obtaining risk related information also varied based on age. Older generation farmers seemed to be content with the knowledge they had received from past generations. When they did have questions, they were more likely to turn to family or friends that had also had experience in agriculture. This result shares similarities with a study by Tyler and Sadiq (2018) that also concluded that individuals were more likely to rely on information when it was presented by
friends or family rather than government organizations at local, state, and federal levels. Younger farmers were more receptive to obtaining information, especially through technological methods such as email, texts, and social media.

**Coping Appraisals**

Coping appraisal is the cognitive process in which an individual looks to analyze and evaluate potential responses (protective action) that could possibly reduce the perceived risk (Floyd, Prentice-Dunn, and Rogers, 2000; Rogers and Prentice-Dunn, 1997). Coping appraisal encompasses response efficacy, self-efficacy and response cost. Response efficacy is the confidence that a behavior will be effective in reducing the perceived threat. Self-efficacy is the belief in which one thinks they are capable of performing the recommended behavior. High threat appraisal with high coping appraisal is said to lead to promote protection motivation.

Threat appraisals interrelate with coping appraisals as farmers assess the effectiveness of protective actions against a threatening risk. Coping strategies, such as building shelters for chickens, vaccine administration, or utilizing pesticides, are then evaluated by farmers to see if they are effective enough at mitigating a potential risk. The respondents’ answers revealed coping appraisals through their responses which will be discussed in the following sections.

**Weather and Climate Events**

To some Arkansas farmers interviewed, weather and climate related events were most commonly viewed as ‘Acts of God’ that they really could not prepare for or do anything to mitigate the risk for the animals. When it came to mitigating for risks such as tornadoes, the respondents articulated that there wasn’t anything that could really be done to prepare for or mitigate the risk.
“I don’t know how you would really [take steps to protect] from that [tornado]. There’s no answer. I mean we have insurance, but I don’t know how you would protect from there being a tornado that could wipe them [cattle] all out.” (R3)

“The weather is just there, I mean that it's a constant risk…. Those [weather events] are hard to predict and you can't really prepare for it a lot of times” (R16)

Alternatively, some respondents did provide some solutions and mitigation efforts to extreme weather-related events. Some of these solutions included cooling cows by utilizing soakers, providing temperature-controlled shelter, and appropriately planning for harvesting and calving season.

“Well, there isn’t much you can do to protect them [from the risk of weather], you just work around it. If we know there is rain, we try to plant or harvest accordingly, the days it is stormy, rainy and nasty, we can concentrate on working inside. When it’s cold, most of them [animals] have a building or shelter to protect them. Sometimes we stack hay for wind blocks or snow barricades. Which also costs more. There are also programs for farmers, drought assistance and insurance.”(R11)

Farmers also suggested that in extreme cold conditions shelters for the animals were also an option to help keep them warm. Poultry farmers specifically mentioned how shelters they have are temperature regulated so that the poultry can remain comfortable all year round. Furthermore, haystacks could be utilized to protect animals from windy conditions.

“When it’s hot we run as many fans and cool fans as we have to try to keep the chickens at 85 degrees or below…. Or if it’s cold we keep the chickens covered and warm”(R17)

In order to protect their own financial stakes and potential losses, farmers looked to insurance as a means to alleviate any financial burdens that would come from weather-related incidents.
Farmers employ strategies such as water irrigation to attempt to mitigate the risk of drought. Those that perceived extreme drought or heat conditions to occur on their operation would try to alleviate the burdens of the hazards by creating their own ponds for animals to drink from, planting crops in a way to ensure growth or reduce the loss of crop, and stocking up on feed supplies during “off season”.

“For droughts we buy crop insurance for our hay to protect ourselves from financial burden” (R2)

Farmers also found they were able to better recover from risks with the help of government-funded programs. To help ensure the stability of the farmers’ agricultural operations and recover from the impact of risks, farmers leveraged these programs.

“There were some government funds available for a drought last summer. I mean, I didn’t mention that as a risk, but that is hard to manage also because we didn’t have a way to water the whole pasture or anything like that….And the government offered assistance which we took advantage of. It allowed us to buy more feed to keep our cattle healthy” (R3)

**Disease and Injury**

Adopting cross contamination practices is the most effective way to prevent and control disease from spreading on farms (Ritter et al., 2017). In an effort to keep the farmers’ operations sanitary and free from disease, there are certain tasks and precautionary measures that can be completed to help ensure the safety of the operation and the animals on it. Some respondents articulated how basic cross contamination prevention practices such as keeping shoes clean, cleaning machinery, and avoiding visiting areas outside of the operation in farm attire were some key elements aiding in helping prevent disease from impacting their operation.
“You just have to kind of follow biosecurity practices....[avoid] wearing the same clothes [you would wear outside of the operation] or using the same vehicle [not designated for farming] around the poultry houses.” (R1)

Often times, farmers and veterinarians are the first to recognize and handle animal disease (Cameron, Pate, and Vogel, 2001). Regular veterinary checkups and administering vaccines were also mentioned in the interviews. Farm animals die every year from preventable diseases. Dating back as early as the 16th century, vaccines have been administered, and they are widely considered to be the one of the most imperative aspects of international disease control today (McVey and Shi, 2010; Tizard, 2017). Fortunately, veterinarians typically supply and administer vaccines that can aid in controlling and preventing the outbreak of potential disease (Cresswell et al., 2013). These practices can potentially reduce livestock morbidity or decrease the mortality rate (Viidu and Mõtus, 2022; Cresswell et al., 2013).

“Part of the management is giving the proper vaccines, and you know, worming them, and making sure that they are healthy” (R3)

Predators

Another risk that poses a significant threat to farming operations is livestock predation. Animals such as coyotes can target livestock operations and attack farm animals, ultimately injuring or killing the farm animal. The threat of predators was not an uncommon risk mentioned by the respondents.

Many of the farmers already took proactive steps to aid in helping their operation from predators such as wild hogs, coyotes, buzzards, and other wild animals. Research has shown that guard animals, predator proof shelters or fences, and hunting or trapping predators can help reduce the amount of unwanted losses (Beranger, Walters, and Bender, 2007; Khorozyan and Waltert, 2019).
Respondents mentioned utilizing fences or enclosures to help protect their animals on the farm. In addition, some farmers mentioned the use of guard animals. Methods most commonly used by the respondents included having a guard dog or donkey and ensuring that fencing secured the animals.

“We have to just kind of live and learn when to recognize that we need stronger fencing here, we need an enclosure for the poultry here because that's where the raccoon got into before. Fortunately, we did not lose any poultry. It [raccoon] just ate their eggs. But, I think any new person doing farming; it's just live and learn. We do have donkeys, we ended up getting some more donkeys and so that has helped with any of the canine or coyote threats.”(R22)

“This breed of dog is a Great Pyrenees. They are great for protection. I've got a few donkeys too. They kind of help with the coyotes. Other than that, you just kind of have to see them [predators] to do something about him. I do have a little bit of trapping set for the coyotes. Hogs, I just shoot them when I see them.”(R7)

When it comes to dealing with humans being threats, farmers look at education as one of the main tools at combating the imminent threat of human harm to their operation. People don’t understand the complexity of farming, and if they did, they may respect it a bit more and understand how crucial farming is to the world.

“People need to be educated” (R15)

Other Perceived Threats

When it came to addressing the fear of machines creating meat alternatives replacing farmers, the respondents didn’t have much to say in regard of ways to mitigate the risk. In an effort to sway people back toward eating meat from animals, farmers would stress the need to educate people to
inform the general public about where exactly meat comes from and what the day-to-day job entails for a farmer.

“I enjoy telling people about the risks and the benefits and the input costs and what we do on a daily basis to make sure they have beef” (R15)

Interestingly enough, farmers did not look at the creation of meat alternatives as a way to diversify their crops. For example, farmers could look into growing foods such as beans, lentils, peas, or other ingredients that are utilized in meat alternatives.

Information

Obtaining and sharing information about farming related topics was not uncommon for the farmers interviewed. Farmers stay informed about emerging risks, practices suited for their operation, weather-related events, and much more through networks of friends, neighbors, and family that are familiar in their field of agriculture.

Community networks within the farming community allow for the sharing of local knowledge that helps foster farming community resilience. Many farmers interviewed shared that they often looked to people they know in the farming community to obtain information about risks for their farm. Other farmers were not opposed to technological adoption and utilized digital tools such as social media to help with decision making skills pertaining to risk assessment and other decisions regarding the safety of their farming operation.

Information salience was obtained variously depending on age gap. While the study did not ask for an age, an examination of age and generational perspective had an impact on where information about a threat was obtained. While older generations were more reliant on hearsay information that had been passed down through generations, younger generations were more apt to rely on modern technology, such as email and text services to obtain information.
Questions regarding weather mitigation practices were generally obtained by hearsay.

"Yeah, game and fish is pretty active with that stuff. They let us know what to look out for, how to trap them, that sort of thing. They encourage not just farmers but, you know, hunters to trap hogs and that type of thing" (R7)

The decision-making process is heavily reliant on information salience. Timely and accurate information optimizes a farmer’s ability to safely and efficiently manage risks. Information about market trends, weather forecasts, disease outbreaks, and more can make a difference on how and when a farmer acts accordingly.

**Monetary Pressures**

Financial success is paramount to ensuring that farmers are able to be to continue their operation. The felt economic strains of farming were vocalized throughout the interviews. To alleviate some monetary pressures, farmers looked at ways of being proactive to combat rising input costs. Farmers suggested stocking up on feed in advance, keeping an eye on market prices, not taking on more than you can handle, and even planting their own feed to help with growing costs of running an operation.

"We grow extra food for the animals.... it helps with feed cost" (R4).

"Do not overload yourself. For one thing, you know, don't get too big that you can't handle it all. (R6)"

Farmers taking proactive measures help mitigate the risk that could cause devastating impacts to their farming operations. Farmers expressed doing tasks such as stocking up on additional feed, vaccinating, setting up fences to prevent predatory attacks, and planning for implement weather can help ease the negative consequences of potential threats to their farming operation.
Protective Actions by Organizations

One of the questions asked was, “Are there steps that other organizations could take that would help protect against the potential risk that you [the farmer] identified?. Specifically, the question was asked in regard to if the government, nonprofits, and corporations could potentially do anything to help protect the farmer from a risk. In general, most farmers did not think that nonprofits could do much in terms of protecting them from a potential risk. The most commonly expressed idea that farmers believed nonprofits could do was to provide educational opportunities to both farmers and people that are not farmers. Farmers expressed a want for nonprofits to educate those not familiar with the farming process so that everyone could better understand what all is entailed in being a farmer.

A concern that farmers had with corporations is they felt that corporations would fold to societal pressures and norms. Respondents expressed that they already felt they had to negotiate with food buyers, and felt that corporations do nothing to help farmers. Farmers expressed that they feel they are vulnerable to corporate power because they have the ability to manipulate prices in the marketplace.

“Problem is there are a lot of meat packers that are getting huge in size, and they have a lot of control over things like the price of chicken or beef. As farmers, we don’t have say. They [corporations] pretty much set the price. The first thing they are worried about is budget; some big economist at a corporation figured all of that out. They set their margins instead of worrying about us [farmers]. (R11)

Attitudes toward government aid varied, but for the majority of respondents there was a negative undertone toward receiving any kind of help from the government. A majority of respondents were also disinterested in having any form of government help. While many of the farmers showed appreciation for any subsidy or financial aid they received from the government, farmers

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were quick to respond with a resounding “no” when it came to asking if the government could do anything to help protect against a risk. It is particularly interesting to note what farmers did not mention. They mentioned the use of insurance, but they did not mention the federal government’s farm bills and support. It’s especially interesting that the farmers want the government to stay out of the way, but they also want to accept money from them (in the form of subsidies, grants, etc.).

“You know, with government really, probably less intervention is better” (R7)

“I would be really happy if the government would stay out of my business” (R14)

A negative stigma around receiving help from the government was also mentioned. Some farmers felt as though if they received government aid, that it was a sign of failure or weakness. Some farmers preferred to address challenges on their farm themselves instead of relying on government assistance.

“Things like that [help] are available. Government hands out assistance then, which is good, but on the same note sometimes we need to make people be self-sufficient. (R11)

The Arkansas agricultural community of cattle ranchers and poultry farmers expressed concerns of numerous potential threats that could negatively impact their operation. Having sufficient information to be able to be aware of potential threats as well as receiving information about how to prepare for those threats is critical. One of the most pressing issues for humanity is food security. With the help of policy makers, scholars, the agricultural community, and other researchers, we can utilize what farmers have identified as perceived threats to better prepare and adapt so that they are able to overcome any challenges that may come their way.
CHAPTER V

CONCLUSION

Farmers are the backbone of ensuring food security. It is critical that farmers are aware of the potential threats to their operations as well as steps that can be taken to help mitigate those risks. Protection Motivation Theory provides a framework for understanding farmers’ risk perception as well as understanding their decision-making process when it comes to risk mitigation. This study aimed to understand what Arkansas farmers’ perceived as risks to their farming operations, as well as where they seek information about risks and mitigation. Additionally, this study examined the protective actions taken by farmers for hazard mitigation purposes.

Farmers from across the state of Arkansas were interviewed to identify what they found to be the biggest risk to their operation. Utilizing Protection Motivation Theory as a lens, it paved a pathway of understanding the risk perceptions of farmers’ as well as their decisions to adopt protective action steps to help mitigate those risks. This research can help policy makers and agricultural stakeholders understand these factors, so that programs and policies may be created or to help farmers better manage future risks.
Key Findings

There are several key findings in this research. It is important to highlight that farmers did identify important risks such as weather, disease, and predators. They also were able to mention mitigation activities such as providing shelters, practicing good biosecurity practices, administering vaccines, and building fences.

Financial Impacts are Most Important

This dissertation was framed in a way that was intended to emphasize food security. However, while Arkansas farmers mentioned perceived threats and mitigation steps, they would always circle back to financial disadvantages. An echoing theme throughout this research was that farmers’ biggest risk is one that is economic in nature. Just as small businesses are an important component of local economies, small farming operations are a significant component to food security (Yoshida and Deyle, 2005). We know from disaster recovery literature that smaller, community-based operations do not adequately prepare for disasters and have a greater difficulty recovering, meaning disasters have bigger impacts on small operations (Yoshida and Deyle, 2005; Haynes, Danes, and Stafford, 2011; Chang and Rose, 2012). Likewise, small farms are vulnerable to many hazards on a higher level than larger farming operations and corporations. Repercussions from a major disaster would impact a corporation, and the recovery process may be difficult; however, most corporations have greater resources, more financial flexibility, and in many cases, the flexibility to relocate operations to one of their other corporate locations. Continuity of a small farming operation after a major disaster may not be feasible.

Perceived Risk and Mitigation Findings

Farmers are aware of the potential for imposing threats to their operations. They were able to discuss numerous risks that they felt would have unfavorable impacts on their farming operation. Adverse weather conditions, disease, animal injury, predators, and market fluctuations were just
some of the risks mentioned during the interview process. While all of the risks had their own impacts, it was apparent that ultimately money and profitability were chief concerns amongst the farmers.

Weather Related Findings

Farmers most commonly perceived weather as a significant risk. Extreme temperatures and various weather events such as drought and tornadoes were mentioned. Most farmers had mitigation steps to combat the negative impacts of weather events such as sheltering animals, stocking up on feed, and utilizing irrigation; however, some weather events, such as tornadoes, were considered hazards that they had little or no control over, so they would let nature take its course.

Ultimately, mitigation activities for climatic conditions and various weather patterns were dependent on the economic impact. Farmers were willing to do anything to ensure that they were able to sell the cattle or poultry to make a profit. If providing shelter or taking other precautions meant they would have an animal to sell at the market, they were more likely to take those mitigation steps. These findings are consistent with prior findings in the emergency management literature focused on individual and household preparedness. Previous studies have shown that individuals consider cost and personal efficacy before taking protective actions (Lindell and Prater, 2002; Lindell, Arlikatti, and Prater, 2009; Greer, Wu, and Murphy, 2020). Additionally, this finding aligns with prior research using Protection Motivation Theory suggesting that personal efficacy is a major contributor to individual protective motivation (Rogers, 1975; Mulilis and Lippa, 1990).

Other Risk Findings

Predators were also mentioned as a significant threat to farming operations. Animal predation was primarily mitigated by building shelters or fences to protect the animals. Further mitigation steps
included placing a guard animal on the premises. Interestingly, some farmers perceived humans to be a “predator”, and dangerous to their operation due to misunderstandings and a lack of knowledge on farming practices. Sometimes people stop on the side of the road to take pictures with the animals, not understanding that the wrong interaction with larger animals can be dangerous. This could become especially dangerous or common as social media “influencers” look for interesting photo opportunities. Farmers suggested that programs be offered to educate the general public about farming operations and “where food comes from”.

Societal pressures, policies, and politics were additional risks mentioned by the farmers. They felt that politicians may not necessarily understand the farming economy, and that they wanted avenues to make their voices and perspectives heard by decision makers. In particular, societal pressures to find meat alternatives and change farming practices to help reduce global warming were areas mentioned where farmers wanted more input in the policy process. Ultimately, farmers felt they needed someone who has had experience in the field to be able to be able to speak on their behalf. They also felt that educational dissemination about farming operations and how farming impacts the globe were also critical to politicians and the average person. These resources may be more broadly available to corporate farms with the income and flexibility to hire lobbyists and work with advocacy organizations. They are less likely to be utilized by the type of small, independent farm operations examined for this project.

Monetary Findings

Farmers felt vulnerable to the ongoing pressures of market fluctuation, increased input costs, and uncertainty surrounding operation production. Profitability and financial stability were ultimately the major dynamic behind farmers’ concerns with nearly all risks and potential mitigation activities for those risks.
To help mitigate risks, there are programs available to farmers. The USDA’s Risk Management Agency (2024) offers crop insurance and has invested in global food security following conflicts in Ukraine that resulted in grain shortages. The USDA’s Risk Management Agent (2024) also offers insurance plans to cover loss of gross margins on livestock and a decline on revenue on dairy milk from cows. There are also programs such as the Rural Development Loan and Grant Assistance that offer opportunities for funding and the Meat and Poultry Processing Expansion Program that offer grants to help promote resilience in our meat and poultry supply chain (USDA, 2024; USDA-ERS, 2024; USDA Press, 2023).

Sadly, programs like these are sometimes less accessible to smaller operations. This is because they do not have the connections or the flexibility in resources and time to research the opportunities and to fill out and maintain the documentation for them. Another reason is simply farmers may not have heard about the programs available to their operations. In some cases, farmers may not have applied to some of these particular programs because they are overseen by the government.

Interestingly, government aid was most commonly frowned upon by the Arkansas farmers. While many of the respondents were appreciative of any help that they received from the government, they still preferred to not receive any type of bureaucratic involvement or aid to their operations. Farmers believed that corporations are not transparent and should take into consideration farmers before setting prices for consumers at markets.

**Information Seeking**

A finding that was not intentionally sought after in this study was how receiving information about a particular risk was dependent on a farmer’s age. Younger generation farmers were more likely to utilize social media, emails, and websites to access information about the biggest risk to
their operation. Older generation farmers were more likely to utilize generational connections with other farmers, friends, and family to receive information about a particular risk.

A holistic approach may be necessary to refine farming mitigation strategies. Farmers and policy makers should consider working together to ensure resiliency. Younger and older generation farmers can learn from one another to integrate the use of modern technological advances as well as utilizing older generational farming practices.

**Theoretical Implications**

Protection Motivation Theory served as the framework for this research. Disaster related research and this theory are typically applied to families and households (Webb, Tierney, and Dahlhamer, 2000). Contextual diversity is often not applied in Protection Motivation Theory. The scope of this research broadens the focus to farmers and looks to open future Protection Motivation Theory research to dive into agricultural communities, and apply it to diverse socioeconomic communities as well. Through the lenses of Arkansas farmers’, this research gained insight into their risk perception, mitigation activities, and means of information seeking. One aspect typically lacking in the theory is it does not consistently address the link between motivation and behavior. This research shows that while there are a plethora of risks capable of threatening operations, the risk of economic failure ultimately takes priority over them all. This research helps bridge the gap of linking intent and actual behavior.

Fear appeals like communicating risks are a motivator in inducing behavioral change. In this research, fear of not utilizing measures was often motivated by economic reasoning. The application of Protection Motivation Theory to farmers’ risk perception creates an expansion for researchers to explore new variables. Studies utilizing Protection Motivation Theory typically look at risks in regard to health, weather, etc. Protection Motivation Theory could be expanded upon in regard to monetary pressures being observed as risks, rather than just as a response cost.
Limitations

There are multiple limitations that need to be considered when it comes to utilizing qualitative design for research. The qualitative findings of this research are not intended to be applied universally as the findings were specifically based off of the aims of this research. Generalizations about the mitigation practices of farmers should not be solely based on the result of this study. Given that sample size for qualitative research and the particular location of this study, it should be noted that it is not representative of all farmers across the globe. That is not to say that the information can’t be beneficial to farmers as a whole, but each group of farmers may have different risks based on other factors such as location.

This research focused on farmers in Arkansas as a foundational examination of farmers’ risk perception, information seeking, and mitigation activities. Additionally, the study focused on poultry and cattle ranchers. This limits the application of the study findings, such that they are not generalizable to the larger population of farmers that grow crops or to farms associated with corporations. Additionally, the data was collected between April and June of 2023, which is only a snapshot of farmers’ experiences. Responses may have been influenced by recent or current events and future events could change perceptions about risk and mitigation to farming operations.

Another limitation is that farmers may feel the need to provide responses that they feel are socially acceptable or maybe something that would “sound good” for the study. This type of bias could incentivize a farmer to hold back valuable information in fear that the answer may not be desirable by the general public.

Future Research

This research solely looked to interview farmers in Arkansas that dealt with cattle and poultry. While these are important farms to the state of Arkansas, there are other valuable types of farms
that future researchers could look at to investigate their risk management practices. Farmers and policy makers could benefit from future research, as risk preparedness and mitigation activities vary depending on variables such as climate, location, and type of animal or vegetation that is on the farm.

As previously mentioned, economic vulnerabilities to farming communities are a major risk to Arkansas farmers. Small farms may have monetary pressures that larger corporations are able to absorb. Future research should examine how corporate farms approach risk management and mitigation. A future qualitative study may be useful to compare how corporations and small farms prepare for financial hardships. This could be difficult research, as many corporations are hesitant to discuss insider secrets, but the effort could help practitioners, policymakers, and academics get a broader understanding of the risk profile to food supply and potential mitigation efforts.

Further studies into how farmers network and learn from their peers in regard to managing risks may provide useful. Future researchers may also benefit in investigating how age may influence and shape how farmers perceive risk as well as how they mitigate for the risk. Intergenerational transference of knowledge pertaining risk management may also be of value for future studies as it may aid in sustaining long-term resiliency of farming operations.

**Concluding Thoughts**

I encourage readers, policy makers, researchers, and those that work in the agricultural industry to take action to aid farmers by ensuring that they receive adequate and reliable information about risks that can potentially impact their operation. Integration of Protection Motivation Theory as it applies to farmers’ risk perception can help support the agricultural community and empower them to make well-versed and knowledgeable choices. Understanding these factors will aid in building resiliency against evolving challenges in the complex world of agriculture.
With the help of researchers, policy makers, and agricultural stakeholders, farmers may be able to create programs and policies that can help farms better manage risks and acclimate to shifting conditions so that they can continue their fundamental position in supplying food across the globe. The findings in this dissertation call attention to the need for supplementary exploration and underscore potential areas for future studies.
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Appendix A

Interview Questions

1. Can you tell me a little bit about your role and what a typical day at “your operation” looks like?

2. What do you view as the biggest risk to your operation?
   
   a. Why are you concerned about this specific risk?
   
   b. Have you received any information from other sources indicating that this is a risk?
   
   c. What are some other potential risks to your operation?
   
   d. Why do these risks concern you?
   
   e. Have you received any information from other sources indicating that this is a risk?

3. What steps are recommended to protect from (whatever they said for question 2)?
   
   a. Where do you get information about those recommended protections?
b. Have you taken those steps?
   i. If no, why?
   ii. Will you try to take those steps in the future?

4. What steps are recommended to protect from (whatever they said for question 2 other risks?
   a. Where do you get information about those recommended protections?
   b. Have you taken those steps?
      i. If no, why?
      ii. Will you try to take those steps in the future?

5. Are there steps that other organizations could take that would help protect against the potential risks that you identified?
   a. Government?
   b. Nonprofits?
   c. Corporations?

6. Now that you have a better understanding of what I am interested in for this research, is there anything that you think I should have asked, but I didn’t?

7. Thank you so much for your time. I know it is valuable. Is there anybody that you think I should talk to next who could provide some insight into this topic?
Appendix B- Statement of Informed Consent

Farmers’ Food Security Preparedness Based on Risk Perception

Statement of Informed Consent

I agree to participate in an interview regarding farmers’ risk perception and preparedness in Arkansas. I understand that the purpose of this study is to understand food security, risks to farming operations, how that information is obtained, hazard adjustments or mitigation efforts utilized, and other information associated with risk perception and food security.

There are minimal risks associated with this study. Anytime an interviewee is asked to discuss emergencies or disasters there is the risk of minor psychological stress and strain. While interviewee names will be kept confidential, communities will be identified in subsequent documents.

I understand that my participation in this study is voluntary, without compensation and that I may refuse to answer any specific questions raised during the interview or end the interview at any time. If I wish to withdraw from the study, I may do so at any time without giving any reason or explanation for doing so. If I do withdraw, I understand that this will have no effect on my relationship with the researcher or the Oklahoma State University.

I understand that the study involves an individual interview that will last approximately thirty to sixty minutes. I understand that this interview will be audiotaped unless I ask that it is not audiotaped, in which case the interview will still occur and detailed interview notes will be taken instead. I understand that I have the option to proceed with this interview via Zoom, Skype, phone call, or in-person. University staff may subsequently contact me to request additional details on topics covered in the interviews.

Interview recordings and transcripts will be kept on a secure computer and may be used for educational or research purposes with the approval of the Principal Investigators. Interview recordings and field notes will be destroyed after transcribed (No later than July 2023). Transcripts will be kept on the secure computer indefinitely for educational or research purposes with the approval of the Principal Investigators. Any mention of the interviewees name will be omitted from the transcript. Instead, a pseudonym or number will be utilized to classify the type of participant/farmer.

The interviewer has answered any questions I had about the study and what would be expected of me. If you have any questions about this study, please contact me at 870-880-0078. Alternatively, if you have any questions about your rights as a participant in this study, you can also contact the Oklahoma State University Institutional Review Board via telephone at (405) 744-3377 or e-mail at IRB@okstate.edu.

Verbal Signature
By verbally agreeing, you indicated that you
- understand your rights as a research subject
- understand what the study is about
- voluntarily consent to participate in this study

_________________________________________  _______________________
Interviewee Verbal Signature                Date

I give my consent to the interviewer to audiotape and video record this interview.

   Yes [ ] No [ ]

_________________________________________
Verbal consent signature

The interviewer may subsequently contact me to request additional details on topics covered during the interviews.

   Yes [ ] No [ ]

_________________________________________
Verbal Signature

_________________________________________  _______________________
Interviewer Verbal Signature                Date

Page 2 of 2
Appendix C- Institutional Review Board Approval Letter

Oklahoma State University Institutional Review Board

Date: 01/30/2023
Application Number: IRB-23-38
Proposal Title: Farmers’ Food Security Preparedness Based on Risk Perception

Principal Investigator: Angelique Fischer
Co-Investigator(s):
Faculty Adviser: Haley Murphy
Project Coordinator:
Research Assistant(s):

Processed as: Exempt
Exempt Category:

Status Recommended by Reviewer(s): Approved

The IRB application referenced above has been approved. It is the judgment of the reviewers that the rights and welfare of individuals who may be asked to participate in this study will be respected, and that the research will be conducted in a manner consistent with the IRB requirements as outlined in 45CFR46.

This study meets criteria in the Revised Common Rule, as well as, one or more of the circumstances for which continuing review is not required. As Principal Investigator of this research, you will be required to submit a status report to the IRB triennially.

The final versions of any recruitment, consent and assent documents bearing the IRB approval stamp are available for download from IRBManager. These are the versions that must be used during the study.

As Principal Investigator, it is your responsibility to do the following:

1. Conduct this study exactly as it has been approved. Any modifications to the research protocol must be approved by the IRB. Protocol modifications requiring approval may include changes to the title, PI, advisor, other research personnel, funding status or sponsor, subject population composition or size, recruitment, inclusion/exclusion criteria, research site, research procedures and consent/assent process or forms.
2. Submit a request for continuation if the study extends beyond the approval period. This continuation must receive IRB review and approval before the research can continue.
3. Report any unanticipated and/or adverse events to the IRB Office promptly.
4. Notify the IRB office when your research project is complete or when you are no longer affiliated with Oklahoma State University.

Please note that approved protocols are subject to monitoring by the IRB and that the IRB office has the authority to inspect research records associated with this protocol at any time. If you have questions about the IRB procedures or need any assistance from the Board, please contact the IRB Office at 405-744-3377 or irb@okstate.edu.

Sincerely,
Oklahoma State University IRB
VITA

Angelique Fischer

Candidate for the Degree of

Doctor of Philosophy

Dissertation:  FARMERS’ FOOD SECURITY PREPAREDNESS BASED ON RISK PERCEPTION

Major Field:  Fire and Emergency Management Administration

Biographical:

Education:

Completed the requirements for the Doctor of Philosophy in Fire and Emergency Management Administration at Oklahoma State University, Stillwater, Oklahoma in May, 2024.

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