THE QUALITY OF MITIGATION PLANS IN LARGE JURISDICTIONS IN THE UPPER MIDWEST

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The Supervisory Committee certifies that this ***disquisition*** complies with North Dakota State University's regulations and meets the accepted standards for the degree of

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ABSTRACT

This study sought to evaluate the plan quality of Hazard Mitigation plans of 30 larger jurisdictions counties in the upper Mid-West. Better plans serve as better guidance for communities to choose better actions and inflict fewer damages. The planning research literature was reviewed to identify important plan components and the plan characteristics that determined the plan quality. The fundamental evaluation characteristics were identified, and those, along with recommended components, were put into an evaluation form. This evaluation form was used to evaluate the county plans, and the findings of the evaluation were discussed. It was found that the quality of the plans was moderate to good. Also, rooms for improvement for plan quality were also identified. The implications of the findings were discussed, and recommendations were made to improve their future quality.

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DEDICATION

This study is dedicated to my family for supporting me directly and indirectly for all my endeavors and helping me reach this position. I owe much to them.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

FEMA .....Federal Emergency Management Association

FIMA.....Federal Insurance and Mitigation Administration

NEHRP .....National Earthquake Hazard Reduction Program

HMGP .....Hazard Mitigation Grant Program

CHAPTER 1. INTRODUCTION

Emergency management consists of four phases- preparedness, response, recovery, and mitigation. These phases are distinguished from one another based on time and tasks involved (Neal, 1997). Namely, preparedness refers to the state of readiness to respond to, recover from, and mitigate against hazard events. Response refers to the immediate actions taken before, during, or after a hazard event to save lives, property, and the environment. Likewise, recovery refers to the differential and complex process by which individuals and households, organizations, and jurisdictions seek to restore, rebuild, and reshape after being impacted by a hazard event. Similarly, mitigation indicates the sustained actions that reduce or eliminate long-term risk to people and property from hazards and their effects (Department of Emergency Management, 2018). The main objective of mitigation is to manage and minimize the risk to reduce potential losses.

Outside of the department of Emergency Management at NDSU, the definition of mitigation, however, varies across cultures, professions, and disciplines. No matter how mitigation is defined, the core value of mitigation is to raise a community's resistance against disasters. Currently, the world is rapidly developing. The advancement in technology, infrastructure, and the global economy has allured everyone's attention to such an extent that they have become oblivious to the potential hazards that occur at the expense of natural balance and environmental quality (Comfort, 1988). Moreover, with the increase in global temperatures and fluctuations in climatic conditions, researchers have found that climate-related hazards are among the primary triggers of massive disasters, causing massive loss of lives and properties (Birkmann & von Teichman 2010). In this context, just getting oneself prepared and focusing on

response is not enough. Mitigation lessens the impacts of disasters and ensures the community's long-term safety (Comfort, 1988).

Because every hazard differs in its nature and impacts, potential mitigation techniques also differ accordingly. For instance, while structures like dikes and levees can mitigate the impacts of the flood, appropriate construction techniques aided by specific building codes help mitigate earthquakes' impacts (Comfort, 1988). In general, there is a practice of applying hazard-by-hazard mitigation techniques and strategies led by diverse groups of experts and specialists. However, the trend has slowly shifted to integrated/coordinated techniques addressing the full range of hazards to which a community is prone. This practice is getting more attention because it focuses on the full range of hazards, taking into account the interaction and overlapping of the hazard while facilitating opportunities for greater efficiency in terms of finances, personnel, and resources for mitigation (Comfort, 1988). However, to attain such mitigation practices, strategic decisions must be made to implement appropriate actions; and, these decisions and actions come from systematic mitigation planning.

Planning is a vital part of mitigation and helps channel the mitigation actions in the appropriate direction. Planning begins with understanding the potential risks and vulnerabilities of the community to various threats and hazards. These risk assessment data are then translated into prioritized goals and objectives for the community, which provides a foundation for effective decision making (FEMA, 2016). In a more specific manner, hazard mitigation plans are the documents presenting policies and strategies that reduce the vulnerability and hazards (Islam & Ryan, 2016).

Often, mitigation is considered a complicated, political, and often expensive process involving navigating a complex system of technical expertise, laws, policies, and ethics (Prater &

Lindell, 2000). Therefore, careful assessment of risks and a step-by-step approach for planning should be a focused.

In the United States, mitigation plans, programs, and policies may exist at various levels. The Federal Insurance and Mitigation Administration (FIMA) under the Federal Emergency Management Agency (FEMA) conducts most of the federal mitigation programs in the United States (Islam and Ryan, 2016). Apart from this, the local government also plays an equally important role in implementing mitigation strategies. According to the Code of Federal Regulations (44 CFR Part 201), any county, municipality, city, town, township, public authority, school, district, special district, intrastate district, a council of government, regional or interstate agency, Indian tribe or authorized tribal organization or Alaska Native village or organization, rural community, unincorporated town or village or public entity; fall under the local government (Islam and Ryan, 2016).

Counties are the most significant form of local government. They serve as a prominent functionary in service delivery for a state becoming a primary service provider for the local communities (Modlin, 2011). They implement numerous federal and state programs that overlap the jurisdictional boundaries of other local government units (Giles et al., 1980). One of the local services and programs that counties offer is hazard mitigation. Disasters are often localized events, and it is important how we plan and implement actions locally to cope with them (Drabek, 2005). Formulating plans at the local level helps achieve locally defined goals working closely with the stakeholders (Berke et al., 2012; Berke et al., 2019). For the achievement of those goals, it is crucial to understand the value of better plan quality. Thus, this study examines the mitigation plans at the county level and evaluates the plan's quality based on various plan components and characteristics discussed in the next chapter.

Background

The evolution of the concept of mitigation and mitigation planning was not fast. Only after the disasters and humans' role in creating them became evident, people began to shift their attention to mitigation apart from response and relief. Before the 1950s, natural disaster was barely the nation's focus, let alone mitigation. The nation was highly concerned with nuclear attack and civil defense (Knowles, 2012). After the series of floods triggered by major Mississippi flooding in 1874, the Flood Control Act of 1917 was passed. With the occurrence of significant floods in Mississippi, the flood control Act was amended and shaped further until the 1936 Flood Control Act was passed that enabled the development of the reservoir, dam, levee, dike, and channelization projects (Islam & Ryan, 2016). Eventually, the focus shifted from nuclear risk to disasters as the United States faced various hazards in the 1960s-1970s such as Hurricanes Betsy, Camille, and Agnes, as well as earthquakes in Alaska and San Fernando Valley, the eruption of Mt. St. Helens in 1980, and the outbreak of tornadoes (Knowles, 2012). The creation of the National Flood Insurance Program was enabled with the National Flood Insurance Act passage in 1968. The Disaster Relief Act of 1974 was another significant act in which Congress mandated specific prerequisites for Financial Aid. Section 406 of the act required all the jurisdiction recipients to initiate the evaluation and mitigation of the hazard (Islam & Ryan, 2016). The 1977 National Earthquake Hazard Reduction Program (NEHRP) created under the Earthquake Hazard Reduction Act provided funding for research, understanding, and mapping seismic hazard and its technical assistance (Islam & Ryan, 2016).

Eventually, FEMA's creation in 1979 gave a different dimension to emergency management, formulating a federal body explicitly tailored to work on emergencies. Mitigation wise, the creation of the Robert T. Stafford Disaster Relief and Emergency Assistance Act of

1988 was significant because the act established the Hazard Mitigation Grant Program (HMGP), which provided grants to state and local governments for implementing long-term hazard mitigation measures. The criteria to qualify for the grants was to develop and adopt Hazard Mitigation Plans (HMP) (Islam & Ryan, 2016). The act was the amended version of the Disaster Relief Act of 1974 and was commonly known as the Stafford Act (Islam & Ryan, 2016).

Meanwhile, in 1995, the then appointed director of FEMA, James Lee Witt, initiated the Project Impact that included all community sectors in emergency management and mitigation. The recurring Great Midwest floods were one of the drivers that led FEMA to emphasize mitigation and minimize the incessant loss. The project aimed to foster public and private partnerships and was designed in all 50 states (Schwab et al., 2017). Because mitigation had emerged as the core element for emergency management, Witt's Project Impact initiative was greatly supported by the government. The project followed a bottom-up approach, and its implementation led to lesser damages in the Seattle earthquake. However, it also underwent criticism such as having a corporate style marketing campaign and lacking inclusion of relevant stakeholders (Knowles, 2012; Schwab et al., 2017).

Shortly after, the Stafford Act's amended version replaced Project Impact and was known as the Disaster Mitigation Act (DMA) 2000 (Islam & Ryan, 2016; Schwab et al., 2017). The DMA 2000 emphasized implementing mitigation planning projects at state, local, and tribal levels. The Hazard Mitigation Plan (HMP) was continued as a condition for disaster assistance with increased incentives for increased coordination and integration for mitigation activities at the state level. Besides, DMA 2000 also created new requirements for local mitigation plans by authorizing up to 7% of HMGP funds available to a state to develop the state, local, and Indian Tribal mitigation plans (Islam & Ryan, 2016). DMA 2000 emphasized mitigation planning at the

local level and ensured all government levels in the planning process (Islam & Ryan, 2016). According to CFR Title 44, Chapter 1, g201.6, "the local mitigation plan is the representation of the jurisdiction's commitment to reduce risks from natural hazards, serving as a guide for decision-makers as they commit resources to reduce the effects of natural hazards." (Islam & Ryan, 2016). Here, the main steps involved in mitigation planning are formulating goals and objectives corresponding to the risks identified, analyzing and prioritizing the necessary mitigation actions, and preparing an implementation strategy to identify the responsible agency, organization, funding source, and time frame for completing each project. Lastly, it involves documenting the planning process to organize the relevant information to meet the Disaster Mitigation Act (DMA) 2000 criteria (Islam & Ryan, 2016). According to CFR, the requirement and procedure for local mitigation plans are:

- A local government must have a mitigation plan approved for receiving HMGP project grants.
- For the eligibility of Flood Mitigation Assistance (FMA) project grants, plans need to address the requirements related to flood hazards and be identified as flood mitigation plans.
- For small and impoverished communities, regional administrators, may grant an exception to the plan requirement. The plan will be completed within 12 months of the award of the project grant.
- Multijurisdictional plans may be accepted as long as each jurisdiction has participated in the process. Statewide plans will not be accepted as multijurisdictional plans.

The planning process shall also include the following:

- An opportunity for the public to comment on the plan during the drafting stage and before plan approval
- An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities as well as business, academia, and other private and non-profit interests to be involved in the planning process
- Review and incorporation of existing plans, studies, reports and technical information

One of the crucial parts of plan formation is collaborating with the affected parties and considering the community's guidance and stakeholders. Having input from various perspectives increases the chance of success while also eliminating errors that go unnoticed by emergency managers (FEMA, 2016; Islam & Ryan, 2016).

Despite the formulation of such plans, programs, and grants, research shows that mitigation has not been adopted to a broader scale. An initial study in 2008 showed that 67% of the country's active local governments lacked approved Hazard Mitigation Plans. A study in 2009 revealed that 92% of the approved plans were completed by multijurisdictional entities, indicating that single governments barely made it through the completion and approval of the plans (Jackman and Beruvids, 2013). By the end of 2015, however, 22,706 communities, accounting for 82.8% of US population had local mitigation plans including both FEMA approved and approval pending adoption plans (Stults, 2017). Based on such results, the federal policy, HMP requirements, are subjected to change along with the change in administration (Jackman and Beruvids, 2013). Since 2002, many amendments have been made in hazard mitigation planning regulations about changes in planning requirements, funding authorization, deadline extension, and similar parameters (FEMA, 2019). In 2008, CWA Section 404 introduced a compensatory mitigation approach for restoring, enhancing, and establishing

aquatic resources (The United States Environmental Protection Agency, 2019). FEMA's Plan Review Crosswalk served as a guiding tool to help local plans to address specifics for the approval of the plans. However, previous mitigation plans focused only on actions related to physical infrastructure and emergency response. In the late years, the plans have also begun to address climate adaptation actions as a part of hazard mitigation so as to reduce the climate related impacts (Stults, 2017).

The government and administrative body of a country change with time, bringing about the changes in laws and regulations. Likewise, the population, infrastructure, land use pattern, and the vulnerability of a region or a nation to hazard also change (Cutter & Finch, 2008). It is essential to track how far these changes influence mitigation plans and their implementation. Therefore, to observe further evolution in mitigation plans, programs, and research, it is essential to tally these changes and their effect in mitigation in a timely fashion.

Significance

We can see that mitigation and mitigation planning has come a long way to be in its position at present. Many plans have been drafted and passed to the respective bodies for the next step. However, in all these, the question that keeps lingering is 'How to make sure if the drafted plan is appropriate and of good quality, and how can we ensure their likelihood for implementation?' Mitigation is a very crucial phase of emergency management, which is backed by the implementation of careful and appropriate planning. Therefore, it is imperative to assess if the plans are of high quality i.e., likely to be implemented.

Mitigation research is lacking in general (Berke et al., 2019; Kang et al., 2010). While some scholars have attempted to address local mitigation plan quality (Berke et al., 2019; Horney et al., 2017; Lyles et al., 2012; Lyles et al., 2014; Lyles et al., 2016; Kang et al., 2010; Kim &

Marcouiller, 2018), and their state (Berke et al., 2012), their attempts exhibit a variety of flaws. This study aimed to introduce a new construct to evaluate the quality of plans and their potential implications for mitigation planning in the future. The resulting information and steps can then be used by local emergency managers to assess the mitigation plan quality, viability, and identify the areas for improvement.

The study also had personal significance because the researcher would learn more about mitigation planning– the area of emergency management where she hoped to base her career on. She shall also be able to apply her analytical skills, which shall be beneficial in the long run for any community, organization, or enterprise she serves.

Conclusion

Counties lead mitigation plans at the local level and try their best to protect their community from disasters' significant impacts. As a mitigation enthusiast, the researcher wanted to assess counties' mitigation strategies through one means—examination of mitigation plans. Chapter 2 relates the literature review that validated the evaluation procedure used to examine plans and elaborates on the ideal process that would have led to those plans. That procedure is presented in chapter 3.

CHAPTER 2. LITERATURE REVIEW

This chapter aims to provide a detailed picture of the components and factors that lead to a perfect mitigation plan. A perfect plan will not materialize in local jurisdictions for any number of reasons. Still, an understanding of plan quality for an ideal plan at the local level is fundamental. The chapter tries to juxtapose the contents suggested by the literature and the evaluation sheet used to study the mitigation plans of 30 counties in total, accounting for five states; North Dakota, Minnesota, Iowa, Illinois, and Wisconsin. Overall, this chapter aims to connect all the chunks and pieces that combine to form a comprehensive and holistic mitigation plan.

Research shows that there is a body of literature on mitigation plans. These literature works reveal more or less similar findings that inform us of local mitigation plan quality and the importance of plan quality for better mitigation. The findings show that the mitigation plan quality was low to moderate overall (Berke & Godschalk, 2009; Kang et al., 2010; Lyles et al., 2012; Lyles et al., 2013). On the international level, the quality of developing countries' local hazard mitigation plan was lower than that of developed ones. They mostly lacked maps and clarity in risk exposure and vulnerability resulting in compromise of the plan quality (Kim & Kakimoto, 2016).

Researchers also advocate how better plan quality enhances a high level of community resilience with fewer damages (Kim & Marcouiller, 2018; Nelson & French, 2002). When these plans are formulated in a "reasonable manner balancing the economic interests of property owners with the interests of the public, land use planning and controls that are coordinated and integrated with myriad interjurisdictional and intrajurisdictional actions designed to promote disaster mitigation, can help protect and preserve human life and property from unforgiving

disasters" (Salkin, 2008, p. 10170). Next, the researchers have also addressed certain elements incorporated in mitigation plans. Looking at State Hazard Mitigation Plans, most of them have included climate change concepts and extreme historical events. Mitigation and adaptation strategies that can help reduce climate change risks have been adopted in these plans. However, these still lack detailed assessment (Hu et al., 2018). Research also pointed out that local governments' financial resources and experience contribute to developing hazard mitigation plans (Yoon et al., 2012).

On the other hand, researchers also point out the significance of damage associated with hazard exposure, structural characteristics, social characteristics, and essential aspects of strengthening planning efforts (Highfield et al., 2014). The other finding on implementing the policies included in the plans termed as 'plan conformance' was moderate. However, the progress rate varied widely due to the type of policy and the State of the local jurisdiction. The findings also indicated that coordination of hazard mitigation plans termed as 'plan influence' was strongest with other emergency management agency led planning initiatives compared to planning initiatives led by other agencies (Lyles et al., 2016).

Moving on to plan evaluation approaches, these bodies of literature have taken more or less similar approaches. Some plans were evaluated on the basis of FEMA's seven principles of plan quality (Lyles et al., 2013; Lyles et al., 2012; Lyles et al., 2016). The items were coded both binarily (Kim & Marcouiller, 2018; Lyles et al., 2013; Lyles et al., 2012; Lyles et al., 2016) and ordinally (Kim & Kakimoto, 2016; Lyles et al., 2013; Lyles et al., 2012; Lyles et al., 2016). A three-point coding protocol was developed to evaluate the State hazard mitigation Plan (Hu et al., 2018). Individual content analysis was conducted first, followed by the reconciliation process to resolve coding differences (Hu et al., 2018; Kim & Marcouiller, 2018; Lyles et al., 2013; Lyles

et al., 2012; Lyles et al., 2016). Statistical checks for reliability (Hu et al., 2018; Lyles et al., 2013; Lyles et al., 2016) and further evaluation was also conducted (Lyles et al., 2013; Lyles et al., 2016) along with web-based questionnaire survey (Lyles et al., 2016). Scaling and standardization of scores were also noted (Hu et al., 2018; Lyles et al., 2013; Lyles et al., 2012; Lyles et al., 2016). Regression models were also employed for some evaluation (Highfield et al., 2014; Kim & Marcouiller, 2018; Nelson & French, 2002; Yoon et al., 2012).

These approaches have sure helped us gain some insight into mitigation plan qualities. However, these evaluation approaches are not entirely reliable. First, the FEMA's seven plan quality principles offer a broad evaluation template, lacking depth in the detailed elements under those principles. Thus, a different evaluation approach was used for this research, comprising base plan elements and mitigation plan elements. The approach is discussed further. Also, since this was individual research, a reconciliation process for resolving codes cannot be feasible in this case. Besides, some plans' grading was not entirely logical. They graded low for the plans that missed mitigation measures for certain hazards, even though the corresponding plan's location was not prone to that same hazard. So, this established an illogical bias compromising the quality scores of the plan. Thus, this evaluation had a different scoring approach. The next sections discuss the necessary elements that were considered for this evaluation.

Recommended Plan Content

The planning research literature has explored several components that are compatible with all phase plans and mitigation plans. This section provides a literature basis that suggests the essential components that apply to all plans. Based on that evidence of content, this research looked for these contents in mitigation plans during the evaluation.

Ideal Contents Reflected in All Plans of All Types

Various research conducted on plan quality and plan characteristics highlight the different elements that shape all phase plans. Berke (1994) stated the most influential characteristics of any plans are fact-based (Berke & Godschalk, 2009; Evans-Cowly & Gough, 2009; Horney et al., 2017; Kang et al., 2010), goals oriented and consist of policies (Berke et al., 2012; Horney et al., 2017; Kang et al., 2010) that guide for creating strategies. While fact basis implies local conditions and needs, goals refer to general aspirations and policies act as a general guide to decisions in terms of locations and their type (Berke & French, 1994; Dalton & Burby, 1994; Lyles & Steven, 2014; Norton 2008). Researchers also point out that plans should remedy the associated problems and guide in decision-making. These decisions are interdependent, meaning a decision depends on other decisions, indivisible, meaning not fragmented into small entities, and irreversible, meaning not being reversed without some cost (Connell & Daoust-Filiatrault, 2018). In case of emergency management plans, identifying the potential hazard and its associated risks and vulnerability are the key components that form the fact-base for the emergency plans (Alexander, 2005; Perry & Lindell, 2007).

Every plan should begin with an end on the mind, and the plan should reflect projects to achieve that end. These projects are only achievable if the fact base is well developed. The envisioned end can be achieved by identifying a vision statement, goals, objectives, and plan scope.

Vision statement

A vision statement of the plan aims to visualize the community after implementing the plan (Baer, 1997; Connell & Daoust-Filiatrault, 2018; Kang et al., 2010). It makes the future

visible and discernible to help in the decision-making process (Balsas, 2012; Connell, 2009; Lyles & Steven, 2014). Having a vision then helps formulate goals for the plan.

Goals

Every plan consists of goals that direct the plan towards its vision, demonstrating commitments to address community needs (Berke & French, 1994; Berke et al., 2012; Kang et al., 2010; Kearns et al., 2014). Goals should be clear and specific and induce specific local plan responses (Berke & French, 1994; Brody & Highfield, 2005; Norton, 2008). Planners then aim to meet these goals by fulfilling specific objectives that help fulfill those goals.

Objectives

Decision-makers operationalize the plans through plan objectives (Kearns et al., 2014; Laurian et al., 2004). Objectives translate into policies and methods implemented to address specific policies and methods (Laurian et al., 2010). Objectives break down goals into something attainable, specific, and measurable, helping to fulfill the plan goals.

Scope

The plan's scope delineates the feasibility, limitations, and structure of the plan (Baer, 1997; Oliveira & Pinho, 2010). It shows the plan's relevance and how the plan can be maximized with the local situation (Berke & Godschalk, 2009; Lyles & Steven, 2014). A good plan has adequacy of scope with the quality of being connected to a larger world (Baer, 1997; Bunnel & Jepson, 2011).

Planning process: Who is involved and how

In any planning, researchers highly advocate that plans should be participatory (Berke, 1994; Brody & Highfield, 2005; Connel & Daoust-Filiatrault, 2018; Evans-Cowly & Gough, 2009; Ha, 2012; Horney et al., 2017; Lyles & Steven, 2014; Norton, 2005; Oliviera & Pinho,

2009; Oliviera & Pinho, 2010; Rabideau et al., 2000, Ubaura, 2015). The planning process should involve stakeholders from various substantive areas based on transparency, consistency, human dignity, equality, property, and public interest (Balsas, 2012). Selection of stakeholder group, the timing for public involvement, sharing of information and aligning evaluation at each stage of the planning process are all-important aspect of the planning process (Berke, 1994; Bunnel & Jepson, 2011; Connel & Daoust-Filiatrault, 2018; Ha, 2012; Kearns et al., 2014; Laurian et al., 2004; Oliveira & Pinho, 2010).

Legal foundation

The legal foundation of any plan is essential to take account of. Federal and state planning mandates do influence plans. Both state hazard, environmental mandates, and other local and political factors should be identified in the planning. The reviewers and the plan implementers understand which regulations must be met (Connell & Daoust-Filiatrault, 2018; Dalton & Burby, 1994).

Hazard analysis

Hazard analysis relates to identifying potential hazards that a community faces or the hazards that are ranked highest concerning risk to the region (Alexander, 2005; Berke, 1994; Berke & Godschalk, 2009; Kearns et al., 2014). The potential hazards should be assessed based on the nature and features of the area. The assessment should include a detailed description of each hazard and their frequency and history of occurrence, providing a specific picture to the readers about those hazards that the communities on the area must contend.

Vulnerability analysis

Vulnerability analysis is the way of assessing the community's susceptibility to potential damages and destruction or the degree of threat posed by the hazard to the community

(Alaxender, 2005; Baer, 1997, Berke et al., 2019; Deyle & Smith, 1998; Kearns et al., 2014). This analysis helps to know how weak or strong the community is in getting affected by the hazard. Several underlying factors determine the community's vulnerability like social, geographical, economic, and infrastructural (Ha, 2012). This section can be backed with corresponding data and information that helps readers relate them to the vulnerabilities.

Risk assessment

Risks are the likelihood of a hazard occurrence, and its assessment helps the planners shape and direct the plans in terms of those hazards (Alaxender, 2005; Berke 1994; Bunnell & Jepson, 2011; Kerans et al., 2014; Oliviera & Pinho, 2009). Risk assessment helps to identify the direct and indirect impacts of the hazard and prioritize the hazards accordingly. The hazard analysis, risk, and vulnerability assessments are interrelated, and consideration is essential for the risk assessment stage.

Merely creating a plan draft is not enough. The plan should be tested and maintained with the changing time frames articulating steps to implement them properly. These parts help to determine the effectiveness and the success of the plan.

Plan testing

Plan testing is essential to measure the effectiveness of the plan. Without plan testing, it is difficult to determine the progress towards the goals (Baer, 1997; Brody & Highfield, 2005). Periodic exercises and assessment of effectiveness help planners adapt to the changing physical, political, and socio-economic landscape and minimize uncertainty by eliminating loopholes (Brody & Highfield, 2005; Connel & Daoust-Filiatrault, 2018). In the case of mitigation plans, testing involves a tabletop exercise designed to allow all entities involved in implementation to assess the plan’s workability.

Plan maintenance

Plans should be maintained to keep them valid across the changing time frames. Regular plan assessments and update procedures should be incorporated to maintain the plan (Brody & Highfield, 2005; Kearns et al., 2014). States or the planning bodies can find effective ways to reinforce changes and updates in plans that support and comply with local situations (Dalton & Burby, 1994).

Plan implementation

Plan implementation is defined as the degree to which plan policies are implemented by applying specified development techniques in planning practice (Oliveira & Pinho, 2010). Every plan should consist of guidance for implementation (Baer, 1997; Bunnel & Jepson, 2011; Connel & Daoust-Filiatrault, 2018; Horney et al., 2017; Kang et al., 2010; Kearns et al., 2014; Oliveira & Pinho, 2009; Talen 1996). This section articulates mechanisms and procedures for implementing the plan once it is adopted, identifies cost or funding for implementation along with roles and responsibilities of involving bodies (Brody & Highfield, 2005). Without good plans, implementation merely becomes an act of carrying out empty policy promises (Berke et al., 2012).

Definitions

Different terms have different meanings across various cultures and disciplines. Thus defining terms is very important in plans so that all the involved parties can understand the proper meaning of the terms about plans (Alexander, 2009). Quality of communication matters highly in plans and providing definitions enhance clarity and eliminates ambiguity or confusion among the readers (Bunnel & Jepson, 2011).

The contents that should be settled in all plans of all types become the 'base plan'. The inclusion of the quality of the base plan components discussed in this section is essential to assess. When looking at mitigation plans, these components were put into Table 1 as an initial step in developing an evaluation tool for mitigation plans. Table 1 provides the breakdown of the components and a description of the specific planning elements that should be addressed for each component. The next section discusses components that should be included in mitigation plans specifically.

Table 1

Base Plan Components

Components	Specific Planning Elements Assessed
Vision	Description of the community's/organization's vision of itself as a result of implementing the plan
Goals	Goals are directed towards the vision
	Goals address sustainability and /or resilience as appropriate to plan type
	Goals are future-oriented, positive statements that can be used to frame policies
Objectives	Objectives are directed toward fulfilling goals
	Objectives are specific
	Objectives are measurable
	Objectives are attainable
	Objectives are realistic
	Objectives are time-bound
Scope	Plan assumptions identified
	Description of plan horizon
	Description of plan development structure role
	Description of plan development structure responsibilities
	Description of plan development structure relationships
	Descriptions of geographic limitations of plan
	Description of administrative limitations of plan
	Statement of how this plan fits with other jurisdictional/ organizational AND emergency management plans

Table 1. *Base Plan Components* (continued)

Components	Specific Planning Elements Assessed
Planning Process: Who and how involved	Description of groups/individual organizations (should show broad involvement)
	Description of numbers involved
	Description of who involved what stages
	Description of the frequency of contact with who involved
	Description of a variety of techniques used to provide information to stakeholders
	Description of number of techniques used to provide information to stakeholders
	Description of variety of techniques used to get information from stakeholders
	Description of number of techniques used to get information from stakeholders
	Description of how stakeholders influenced the process
Legal Foundation	Description of authority to plan provided by federal, state, and/or local regulations
	Description of duty to plan provided by federal, state, and/or local regulations
	Descriptions of standards referred to in process of plan development
Hazard analysis	Process used to identify hazards explained
	Any assumptions/limitations associated with process to identify hazards explained
	Potential types of hazards listed
	Description of characteristics of each hazard
	Mapping and/or modeling of hazards demonstrated
	Sources of data described (multiple sources referred to)
Vulnerability Analysis	Process used to assess vulnerabilities explained
	Any assumptions/limitations associated with process to identify vulnerabilities explained
	Geographic vulnerabilities assessed
	Assessment of geographic vulnerabilities data informed
	Assessment of geographic vulnerabilities based on reliable data
	Social vulnerabilities assessed (i.e., health care system, employment, poverty index, languages spoken in area, educational background, gender, age, rent vs. own)
	Assessment of social vulnerabilities data informed
	Assessment of social vulnerabilities based on reliable data
	Special needs understood and addressed as appropriate to plan type (i.e., communication, medical, maintaining functional independence, supervision, transportation, pets)
	Economic vulnerabilities assessed (i.e., infrastructure, businesses, critical facilities, industry)
	Assessment of economic vulnerabilities data informed
	Assessment of economic vulnerabilities based on reliable data

Table 1. *Base Plan Components* (continued)

Components	Specific Planning Elements Assessed
Risk Assessment	Process used to assess risk explained
	Any assumptions/limitations associated with process to identify risk explained
	Direct impact assessed
	Indirect impact assessed
	Assessments are data informed
	Data used is reliable
	Likelihood established
	Hazards prioritized/ranked
	Relationship of hazard, vulnerability and risk processes to planning described
Plan Testing	Schedule of periodic ongoing training
	Identification of who will be targeted in training
	Identification of the purpose of training
	Identification of how feedback will be provided and incorporated from exercises
	Schedule of periodic ongoing exercise (if applicable)
	Identification of who will be targeted in exercises
	Identification of what will be tested in exercises
	Identification of how feedback will be provided and incorporated from exercises
Plan Maintenance	Specifies time frame on an ongoing basis in which the plan will be reviewed
	Specifies time frame on an ongoing basis in which the plan will be revised
	Describes the process by which maintenance will be conducted
Plan Implementation	Responsibility for implementation identified
	Identification of human resources acquired
	Identification of financial resources required
	Identification of technical resources required
	Discussion of how resources will be acquired
	Description of how the evaluation will be handled including indicators
	Inclusion of flexibility statement
Definitions	Definitions of key terms and phrases are provided

Ideal Contents Reflected in Mitigation Plans

Along with the base plan components, that is to be there in every plan, some specific components need to be present in mitigation plans. These components were derived from a comprehensive literature review that identified the ideal content that should specifically be included in mitigation planning. Researchers (Highfield et al., 2014; Hu et al., 2018; Kim & Kakimoto, 2016; Kim & Marcouiller, 2018; Lyles et al., 2012; Lyles et al., 2016; Lyles et al.,

2014; Nelson & French, 2002; Salkin, 2008; Yoon et al., 2012) have identified eight specific components that comply with ideal mitigation plans. They are general policy, regulatory tools for hazard zone, modeling technique and tools, incentive-based tools, structural tools, public facilities and infrastructure, awareness/educational tools, and natural resource protection. Plans may not necessarily have all of these components. They might tend not to have some of these components, but it is desirable, even if not all, but most of them are included and clearly addressed in the plans. They are further discussed in detail below.

General policy

Having effective regulatory tools is vital for minimizing risk and implementing mitigation plans (Berke et al., 2019; Salkin, 2008). These tools help steer the development away from sensitive lands rather than enhancing community growth avoiding greater risks (Highfield et al., 2014; Kim & Kakimoto, 2016; Nelson & French, 2002; Salkin 2008). These adoptions of general mandates in hazard mitigation and coordination with the local and regional governments play an excellent role in mitigation planning (Kim & Marcouiller, 2018; Lyles et al., 2016).

Regulatory tools for hazard zone

Various regulatory tools have been identified in the literature to form robust mitigation plans for any hazard-prone areas. Local policy and regulatory documents like building codes, land use, zoning, subdivision regulations, local zoning ordinance, setbacks, floodplain management tools; all help enhance the mitigation plan quality (Berke et al., 2019; Kim & Marcouiller, 2018; Salkin, 2008). Such regulatory tools help guide development to safe locations while encouraging builders, developers, and planners to formulate strategies for safer and resilient communities (Highfield et al., 2014; Hu et al., 2018).

Modeling technique and tools

Hazard modeling is essential while assessing risk. Various software and tools like GIS help create visualized maps showing areas and communities at risk and prioritize hazards and communities accordingly (Hu et al., 2018; Lyles et al., 2016). These modeling techniques provide better ideas about risk profile to the developers and planners and formulate better mitigation plans and strategies that best suit the area.

Incentive-based tool

Incentive-based tools are also the other important component of mitigation plans. They encourage planners, developers, stakeholders, and the entire community to comply with mitigation plans (Berke et al., 2019; Lyles et al., 2012; Yoon et al., 2012). Retrofitting private structures, tax abatements, and National Flood Insurance Programs are examples of incentive-based tools that can be included in mitigation plans to ensure its better quality and implementation.

Structural tools

Often mitigation measure is linked with structural controls. Engineered structures like dikes, levees, and seawalls help control disaster-induced damages and significantly reduce the impact. So, these structural control tools are of great consideration in mitigation planning (Highfield et al., 2014; Kim & Kakimoto, 2016; Lyles et al., 2014; Lyles et al., 2016). Structural tools balanced with non-structural tools in mitigation planning make the plan holistic and enhance plan quality (Kim & Kakimoto, 2016).

Public facilities and infrastructure

Mitigation plans should not only focus on saving lives and personal properties but also should incorporate tools and mechanisms to reduce impacts on public facilities and infrastructure

(Lyles et al., 2014). Mitigation planners and developers can prepare capital improvement plans with mitigation activities making choices about future spending for infrastructure (Salkin, 2008). Retrofitting public structure, protecting them, and making an adjustment to public infrastructure can also be included as a part of mitigation plans (Lyles et al., 2012).

Awareness/educational tools

Plans should be informative and generate awareness among all the entities involved in the process and implementation (Lyles et al., 2012). Mitigation plans should include awareness and risk communicating tools like disaster warning, data, tools, and guidance for exchanging, sharing, and integrating knowledge about risk among all the stakeholder groups (Hu et al., 2018; Lyles et al., 2012). Likewise, plans should also incorporate technical assistance for the developers to produce and disseminate accurate information about the hazard (Lyles et al., 2012; Yoon et al., 2012). It is also equally important to include information about the local critical facilities like police, fire stations, and hospitals and provide their location through hazard maps so that necessary actions can be taken at the time of emergencies without spending extra time (Kim & Kakimoto, 2016).

Natural resource protection

When it comes to hazard mitigation, natural resources also play a significant role. Resources like forests, wetlands have protecting features that provide mitigation benefits (Endter-Wada et al., 2018; Endter-Wada et al., 2020; Espeland and Kettenring, 2018; Lyles et al., 2016; Tanaka, 2009). Therefore, an adequate mitigation plan should include natural resource protection and ecosystem conservation policies and mechanisms that help mitigate the potential hazards and keep the community safe (Hu et al., 2018; Kim & Kakimoto, 2016; Lyles et al., 2016).

Table 2 provides the breakdown of the Mitigation Specific components and the possible set of tools or actions that could be included in the plans.

Table 2

Mitigation Plan Components

Policy	Steps
General policy	Discourage hazardous area development
	Support adoption of new regulatory legislation at the local level
Regulatory tools for hazard zone	Permitted land use
	Identifies low-density conservation
	Identifies overlay zone with reduced density provisions
	Identifies open space dedications
	Identifies policy to locate public facilities to non-hazardous area
	Development rights transferred
	Identifies cluster developments
	Identifies setbacks
	Site plan review
	Special study/impact assessment of development
	Building standards/codes
	Land and property acquisition
	Identifies impact fees
	Identifies special assessments
	Retrofitting of private structure
	Relocation of structures out of hazard zones
	Identifies drainage ordinance
	Identifies zoning
	Non-conforming use regulations
	Subdivision ordinance
	Identifies differential taxation
	Limiting services to areas
	Floodplain regulation including management, development ordinance and downzoning
	Others
Modeling techniques and tools	GIS maps
	Risk profiles
	Others
Incentive-based tools	Land and property acquisition
	Retrofitting private structures
	Tax abatement for mitigation
	Density bonus
	Low-interest loans
	NFIP
	Others
Structural tools	Identifies levees, seawalls, riprap or bulkheads
	Detention ponds
	Channel maintenance
	Slope stabilization
	Stormwater management
	Sewage/drainage management
	Maintenance of structures

Table 2. *Mitigation Plan Components* (continued)

Policy	Steps
Public facilities and infrastructure	Identifies capital improvement plans Retrofitting public structure Retrofitting critical facilities Relocating infrastructure Others
Awareness/educational tools	Identifies education/training opportunities for community, staff, private stakeholders and students A real estate hazard disclosure Identifies hazard notification provision Maps of areas subject to hazard Disaster warnings and response programs Hazardous signage and related location Technical mitigation assistance Inclusion of floodplain boundaries Identifies workshops/education training in several languages Hazard information center Others
Natural resource protection	General description of best management practice Identifies forest and vegetation management of riparian areas Sediment and erosion control Stream dumping regulations Includes urban forestry and landscapes Soil conservation and steep slope preservation Dune preservation Wetland protection and preservation Others

Quality Characteristics of Ideal Plan Content

Including key components in plans is an important part. However, just having a narrative is not synonymous with quality, and quality is vital for implementing a plan. While not all literature has adherence to the same quality characteristics, five essential qualities have been deduced, constituting quality characteristics for plan components. They are inclusiveness, comprehensiveness, clarity, internal compatibility, and external compatibility.

Inclusiveness

The first and foremost main quality characteristic of the plan is inclusiveness. Initially, founding the plan with fact bases, goals, and policies, a good plan should also include all the base plan components like vision, goals, objectives, scope, and similar components, as discussed

earlier (Berke, 1994; Brody & Highfield, 2005). A good plan should provide content and format of key components and provide an all-round picture of the plan (Lyles & Steven, 2014).

Comprehensiveness

Researchers highly advocate for the plan to be comprehensive (Alaxender, 2009; Berke, 1994; Berke & French, 1994; Berke et al., 2019; Brody & Highfield, 2005; Balsas, 2012; Connel & Daoust-Filiatrault, 2018; Dalton & Burby, 1994; Deyle & Smith, 1998; Lyles et al., 2014; Lyles & Steven, 2014; Nelson & French, 2002; Oliveira & Pinho, 2009; Salkin, 2008). Plans should be descriptive and delineate all the important parts about the issue (Alaxender, 2009). The more comprehensive the plan, the easier it is to analyze it and provide a solution for the issue (Balsas, 2012). This is particularly true concerning mitigation plans where full implementation is desired (Nelson & French, 2002) as opposed to response plans, for example, where flexibility in implementation and improvisation must be expected (Drabek, 2005)

Clarity

The other important plan quality is its clarity. Literature suggests that plans should clear, concise, explicit, well-articulated, and avoid any ambiguity (Baer, 1997; Connel & Daoust-Filitrault, 2018; Laurian et al., 2004). The clarity in the language matters because these plans are viewed by different groups of people from different backgrounds and expertise. Thus, jargon should also be avoided as far as possible so that all the involving groups understand the plan. Even if jargons have to be used, reference should be provided in the plan document that helps the readers extract the meaning immediately (Bunnel & Jepson, 2011).

Internal compatibility

Literature suggests that plans should be internally compatible (Balsas, 2012; Laurian et al., 2010; Lyles et al., 2012; Lyles & Steven, 2014; Norton, 2007; Oliveira & Pinho, 2010;

Rabideau et al., 2000). Internal compatibility identifies the plan's connectedness or ties to a key component's content and format (Lyles & Steven, 2014). This also means that an internally compatible plan has its sections fitted and hanged well together. Authors also term this internal consistency or internal coherence (Balsas, 2012; Laurian et al., 2007; Norton, 2008; Oliveira & Pinho, 2010; Rabideau et al., 2000) and state that a good plan satisfies this compatibility. This characteristic of the plans shall be evaluated by checking for any contradictions present and ensuring the plan components support the plan's stated vision, goals, and objectives.

External compatibility

External compatibility refers to "the relevance of the scope and coverage to reflect stakeholder values and the local situation to maximize use and influence of the plan" (Berke & Godschalk, 2009; Lyles & Steven, 2014). An externally compatible plan is formulated through the community's needs and is backed by the same community's support. External compatibility is a crucial plan quality that determines the usability of the plan (Baer, 1997; Berke & Godschalk, 2009; Bunnel & Jepson, 2011). It is also important to remember that external compatibility cannot be assessed by looking at the paper plan. The assessment is undertaken during the planning process.

The plan evaluation process looked at local mitigation plans that were selected for the study. Based on the literature, each component identified in Tables 1 and 2 will be evaluated, looking first for inclusiveness. If included, the component will then be evaluated on comprehensiveness, clarity, and internal compatibility of included components. Since external compatibility cannot be assessed through the paper plan, this is a significant limitation for the study.

Other Important Aspects of the Planning Process

While important components of plan and plan quality have been discussed in the above sections, it is also equally important to know about the ideal planning process's steps or stages. Only after following the appropriate steps, the plans can be robust and compatible in every way. Kelly (2010) has pointed out six stages involved in the planning process. The first one is data gathering. It is the process of gathering or collecting the relevant data to form a strong factual basis for the plan (Kelly, 2010). The second step is data analysis. This step involves an in-depth study of the collected data and involves establishing a relationship between data and the type of plan produced (Kelly, 2010). The third step is policymaking. This step involves building strategies and tactics for the plan based on analyzing the gathered data (Kelly, 2010). After this, the fourth step is policy adoption, in which the multiple parties represented in the plan formally agree to finalize and adopt the plan (Kelly, 2010). The fifth step is plan implementation. This step involves executing the plan in the real world. Plans usually are adopted after the policy adoption, but they can still vary with the plan's context and type (Kelly, 2000). The last step is maintenance and revision. This step involves revising the plan and correcting the deficiencies and flaws (Kelly, 2010).

Following these planning processes is important and helps build better plans. However, it also matters how these steps are taken and worked through. First, plans should be internally driven (Bunnel & Jepson, 2011). It means a plan is internally driven when the creators of the plan also drive the planning process rather than being created in response to a mandate (Ajdari, 2016). Second, the planning process should be inclusive. Plans should be participatory and include a broad range of stakeholders who can contribute their relevant knowledge and expertise for the plan (Alaxender, 2009; Balsas, 2012; Berke, 1994; Brody & Highfield, 2005). Third, the

planning process should be consensus-based, meaning all the involving parties agree with the result. Lack of consensus may result in a problem in implementation (Alaxender, 2009; Balsas, 2012; Oliveia & Pinho, 2010). Fourth, the planning process should be transparent. It should be clear and well-articulated that it is comprehensible for all the stakeholders (Baer, 1997; Laurian et al., 2010). Fifth, plans should be evolving. It means that the plans should accelerate from one step to another while also ensuring that the steps are done right and repeat if necessary. In a way, this reduces the plan's loopholes and enhances the plan quality (Kelly, 2010). Lastly, plans should be informed (Alaxender, 2009; Baer, 1997; Balsas, 2012; Oliveira & Pinho, 2010), meaning they should be based on relevant facts, data, and stakeholders' knowledge and expertise. This helps identify the exact problem and come up with the appropriate solution and necessary resources.

Apart from these, public participation or participation of a diverse group of stakeholders is crucial in the planning process. The different groups of experts with specialized knowledge make planners and other parties aware of risks and what can be done about them (Berke, 1994). Involving relevant stakeholders in the development and design of plans strengthens the plan quality (Alexander, 2009). Involving the public in the planning process fosters their interest in mitigation, increasing the support for the plan policies while also providing them with a sense of ownership for the plan (Baer, 1997; Evans-Cowly & Gough, 2009; Oliveira & Pinho, 2010).

Similarly, planning can occur or is developed in a different context or scenario. According to Perry & Lindell (2007), there are mainly three different planning contexts. These contexts are also likely to affect the plan quality. The first one is the jurisdictional context. In this context, emergency planning is the local jurisdictions' responsibility, and planning occurs within them (Perry & Lindell, 2007).

Along with the jurisdictional effort, if the plan is further supported by local officials, citizens, and response agencies, plans can be conducted well (Perry & Lindell, 2007). Also, if the jurisdiction has prior disaster experience, making them prioritize emergency planning before anything, it makes them devote reasonable time and resources in planning to enhance the quality of the plan (Perry & Lindell, 2007). The next important context is the public policy context. Public policy refers to the rules and regulations at various administrative levels from the county to state to federal. These rules and regulations also play significant roles in framing the plan, like what a plan must include, what time it must be completed, and who can be involved (Perry & Lindell, 2007). The third context is the emergency management context. Emergency management is an emerging discipline and profession and aims to build the capacity to fight against the impacts of disasters. For that, one of the main tasks that involve this sector is planning. However, this task can be affected by several factors like expertise in emergency management, time availability of the planning staff, and the number of people in the sector (Perry & Lindell, 2007). Like jurisdictional and policy context, emergency management context is also very significant in shaping the design, quality, and direction of the mitigation plans.

Conclusion

In this chapter, important components of the base plan for any plans and components necessary for mitigation specific plans were identified along with the quality characteristics of those components. The findings from the evaluation of 30 mitigation plans were carried out using the evaluative criteria discussed in this chapter. The methods to extract the findings and their significance are discussed in the next chapter.

CHAPTER 3. METHODS

This chapter describes the methodology for this study of county mitigation plans. The research aimed to examine the plan's content and the extent to which the plans exemplify the characters and contents the literature says should be there. For this process, the most appropriate method to use was content analysis.

Content Analysis

Content analysis is a research technique intended for the systematic examination of materials from which various information can be derived (Berelson, 1952; Flick et al., 2004). Researchers are always looking for information that can be translated into valuable results. Content analysis helps them infer results in a systematic and replicable manner, reducing or compressing the textural material into fewer content categories and manageable data (Stemler, 2001; Weber, 1990). This method is mostly applicable while analyzing large documents, interviews, publications, or diplomatic messages (Weber, 1990). Social scientists generate essential findings from these extensive data using content analysis (Weber, 1990).

Content analysis is mostly useful in examining trends and patterns in the documents and evaluating their effectiveness based on a set of standard criteria (Stemler, 2001). For this research, content analysis was employed to gather inferences for the mitigation plan quality and analyze them with the features and criteria discussed in Chapter 2.

Evaluation Form

The information and findings gathered from content analysis were compared and tallied to each of the specific components listed in the evaluation form. This form was a carefully formulated used to compare and score the plan components present in each of the evaluated mitigation plans.

A literature-based evaluation worksheet (Appendix A) was used to review each plan. The form was broken down into two parts: base plan components that should be included in all parts regardless of type and components that should be explicitly included in mitigation plans. Plan components were identified through the research literature, and specific planning elements are identified for each component. All the plan components (as seen in leftmost column in Appendix A) were valued equally. These components represented different topical yet equally important areas that the plans should include. The extant of literature that were explored for this study had also placed same value for each component. Each component was then to be scored in two steps. The first part would be evaluating whether the required component was included in the plan or not. One point was given if the component was included in the plan and zero if it was not included. The second part of scoring then involved evaluating the quality of the included content in terms of its Comprehensiveness, Clarity, and Internal Compatibility. The total possible points associated with each of these characteristics varied. For comprehensiveness, a point was assigned for each specific planning element addressed. Internal Compatibility and Clarity were evaluated out of 2 points each. Plans that fulfilled the criteria received full points for each. Points were deducted if the criteria were partially fulfilled or not fulfilled at all. After completing the evaluation, the points for each quality characteristics (Inclusion, Comprehensiveness, Internal Compatibility, and Clarity) were totaled, and the overall plan quality was derived for each plan.

Sampling

For this research, appropriate county mitigation plans that met the designated criteria were selected to derive their plan quality. Three significant criteria were employed for the selection of the plans. The first criterium was, the county had to lie in the upper Mid-West.

The second criterium was the larger jurisdiction counties, meaning those with a population of 100,000 or greater. The population is often considered one of the main factors in determining the risk and vulnerability to disasters (Ardaya et al., 2017; Donner & Rodriguez, 2008; Tenerelli et al., 2015). Population data are accounted while designing disaster risk models which later, transcends to the appropriation of mitigation measures along with appropriate preparedness, response, and recovery (Tenerelli et al., 2015). High population density, coupled with unplanned land use, tends to exacerbate the disaster impacts (Ardaya et al., 2017). Hence, it would not be undeniable to say that counties with greater population have a greater responsibility towards hazard planning for better execution of mitigation actions and overall safety of the place.

The third criterium was the availability of the plans on the internet. Availability on the internet helped in easy access and downloading of the plans, which could be safely stored and reviewed at our own convenience. This also prevented the task of approaching concerned authority for the provision of the plans, facilitating ease in the research.

For this process, first, population data of each county for a particular state were assessed. The search began from North Dakota, followed by the neighboring states. Counties with a population greater than or equal to 100,000 were duly noted, followed by the web search of their hazard mitigation plans. The plans were mostly obtained from direct google search, while in a few cases, from the official website of the counties. Counties whose plans were not available on the internet, despite being a larger jurisdiction, were discarded, and additional plan search was carried on for next states. This process was continued until the availability of sufficient number of suitable plans was checked. Table 3 shows the potential plans that could be analyzed based on the criteria discussed above.

Table 3

Potential Plans for the Study

State	Counties	Population ≥ 100k	Plan available (Y/N)	Comments (if any)
North Dakota	51	Cass	Y	
South Dakota	66	Minnehaha	Y	Combined with Lincoln County
		Pennington	N	
Minnesota	87	Hennepin	Y	Available in 3 documents
		Ramsey	Y	
		Dakota	Y	
		Anoka	Y	
		Washington	Y	
		St. Louis	Y	
		Stearns	N	
		Olmstead	Y	
		Scott	Y	
		Wright	N	
		Carver	Y	Viewable online
Iowa	99	Polk	Y	Viewable online
		Linn	Y	
		Scott	Y	Bi state
		Johnson	Y	
		Black Hawk	Y	
		Woodbury	Y	
Illinois	102	Cook	Y	
		DuPage	Y	
		Lake	Y	
		Will	Y	
		Kane	Y	
		McHenry	Y	
		Winnebago	Y	
		Madison	N	
		St. Clair	Y	
		Champaign	Y	
		Sangamon	Y	
		Peoria	Y	Tri-counties plan
		Rock Island	Y	
		Tazewell	Y	Tri-counties plan
		Kendall	Y	
		Kankakee	Y	
		LaSalle	Y	Combined with 4 other counties
		Macon	Y	
		Dekalb	Y	
Wisconsin	72	Milwaukee	Y	
		Dane	Y	
		Waukesha	Y	
		Brown	Y	
		Racine	Y	
		Outagamie	Y	
		Winnebago	Y	
		Kenosha	Y	
		Rock	Y	
		Washington	N	
		Marathon	Y	
		La Crosse	Y	
		Sheboygan	Y	
		Eau Claire	Y	
		Walworth	N	
		Fond Du Lac	Y	

A total of 49 plans were obtained that fulfilled the above stated criteria. However, some plans had to be further discarded. One reason for discarding some of the obtained plans was that those plans were merged for two or more counties. Single county, single jurisdiction was preferred, and plans that were representative of 2 or more counties were discarded. While some of the selected plans were still multijurisdictional but, in such case, the multijurisdictions were the townships or villages within that one county, representing as a single plan for the county. Weighing all the criteria and limitations for the plan selection, the advising committee of the research settled on analyzing a total of 30 plans for the study. While no specific amount was allocated per state, as the motive of the research was to evaluate on a regional basis, effort was made to work on the criteria met plans of multiple states. Hence, the evaluation covered 30 large jurisdictions counties spread across five states in the upper Mid-West. The final 30 plans are listed in Table 4.

In addition to evaluating 30 different plans, the study also aimed to find the significant similarities and differences among these groups of plans and assess their subsequent strengths and weaknesses, providing us with the picture of overall plan quality. This research shall also help improve the quality of the study so that future research can refer to these results while carrying out similar plan studies. Apart from that, these findings would greatly help assess the shortcomings in the plans and find ways to improve them.

Since the project was simply an evaluation of publicly available plans and did not involve interviewing any human subjects, the Institution Review Board (IRB) approval was not required.

Table 4

The Final 30 Plans Analyzed for the Study

S. N	State	County
1.	North Dakota (N=1)	Cass
2.	Minnesota (N=9)	Hennepin
3.		Anoka
4.		Dakota
5.		Ramsey
6.		St. Louis
7.		Washington
8.		Olmstead
9.		Scott
10.		Carver
11.	Wisconsin (N=7)	Dane
12.		Fond du Lac
13.		La Crosse
14.		Outagamie
15.		Sheboygan
16.		Marathon
17.		Milwaukee
18.	Iowa (N=4)	Johnson
19.		Linn
20.		Black Hawk
21.		Woodbury
22.	Illinois (N=9)	Winnebago
23.		Champaign
24.		Kendall
25.		Sangamon
26.		Macon
27.		Kankakee
28.		DuPage
29.		Cook
30.		Dekalb

Limitations

This research was intended to add valuable findings to the mitigation planning literature and help planners and emergency managers formulate and implement better mitigation plans. However, the study also had some limitations that need to be considered.

First, the research only evaluated 30 plans out of thousands of county plans in the United States. Therefore, the findings are not generalizable to all the county plans. However, this does not mean that unevaluated counties cannot refer to this evaluation and find value in the results.

Second, since this research just evaluated the paper plans, external compatibility could not be assessed. Hence, it could not be evaluated even though it is one of the essential plan qualities.

Third, the plans' selection was made based on convenience, i.e., having a population equivalent to 100,000 or more and their availability on the internet. Therefore, plans that were not available on the internet are not evaluated. Possibilities may be there that the unevaluated plans offered different results from what was observed for this study.

CHAPTER 4. RESULTS

This chapter talks about the evaluation scores of the examined plans, their associated findings, and their significance in terms of the plans' quality. The chapter has been divided into two major sections, base plan component score and mitigation specific scores. The Base Plan Component Score section provides a detailed overview of the four quality characteristics scores throughout all 30 plans pertaining to base plan components. The mitigation specific score section provides a detailed overview of the four quality characteristics scores throughout all 30 plans pertaining to mitigation specific components.

Base Plan Component Score

Plans were evaluated based on 13 components in the base plan section as described and tabled in Chapter 2. As mentioned previously, these components were scored on the basis of 4 evaluation criteria or quality characteristics, inclusion, comprehensiveness, internal compatibility, and clarity. In this section, details are provided on the evaluation scores in terms of these quality characteristics.

Inclusion

Inclusion was identified as the first and foremost quality criteria of the plan. So, the evaluation was initiated by identifying the components' inclusion. Plans received a score if the specific component's inclusion was detected and were scored null if they lacked. To better understand, here is an example. Since they were a hazard mitigation plan, all plans had identified and talked about the major hazards occurring in the county. Hence, the plan instantly received 1 point for inclusion of hazard analysis.

On the other hand, the plans significantly lacked a vision statement and could not be located despite going through the entire plan. This automatically resulted in a null point for the

inclusion of vision. This process was continued throughout the whole evaluation process across each component, for each plan, for each county.

First, the component-wise analysis was done. Here, the number of counties was noted that included each of the base plan components in their plan. Table 5 below shows the summary of this result.

Table 5

Number of Counties Including Each of the Base Plan Components

Base-plan Component	Number of counties that included (out of 30)
Scope	30
Risk assessment	30
Planning process: who and how involved	30
Hazard analysis	30
Plan implementation	29
Legal foundation	29
Goals	29
Vulnerability analysis	28
Plan maintenance	27
Definition	24
Objectives	13
Vision	4
Plan testing	1

This information can also be assessed from the Final Detailed Score Chart in Appendix B. It was found that plan testing was barely included in any plans. Vision and objectives were the other two components that were least included in the plans. However, the other components were included frequently by the plans in which all plans at least included scope, risk assessment, planning process, and hazard analysis.

Likewise, the inclusion scores received by each of the counties were also noted. Table 6 below shows the summary of inclusion scores of base plan components for all 30 counties.

Table 6

Inclusion Score Summary of All Counties for Base Plan

County	State	Inclusion Score (out of 13)
Champaign	IL	12
Cook	IL	12
Woodbury	IA	11
Winnebago	IL	11
Kendall	IL	11
Kankakee	IL	11
St. Louis	MN	11
Washington	MN	11
Scott	MN	11
Cass	ND	11
Milwaukee	WI	11
Johnson	IA	10
Linn	IA	10
Black Hawk	IA	10
Sangamon	IL	10
DuPage	IL	10
Dekalb	IL	10
Hennepin	MN	10
Dakota	MN	10
Ramsey	MN	10
Olmsted	MN	10
Fond Du Lac	WI	10
La Crosse	WI	10
Marathon	WI	10
Macon	IL	9
Carver	MN	9
Outagamie	WI	9
Sheboygan	WI	9
Anoka	MN	8
Dane	WI	7

Out of a total of 13, the inclusion score ranged from 7 to 12. Cook and Champaign County in Illinois scored the highest while Dane County in Wisconsin scored the lowest. This lowest score was followed by Anoka County in Minnesota, with the total inclusion score of 8. The majority of the counties had a score of 10, followed by a score of 11.

Comprehensiveness

Plans were considered comprehensive if they had identified key elements building around the base plan components. A score was provided for each key element addressed and awarded null if found missing. To better understand this, examples of comprehensiveness scores for vision and hazard analysis are assessed. Figure 1 shows the inclusion and comprehensiveness scores of vision and hazard analysis component. This example is taken from Dakota County, Minnesota.

Figure 1

Comprehensiveness Score Evaluation 1

Component & Sub-Components	**Inclusio**	**Specific Planning Elements Assessed**	**Compr**	Comments
Vision	1/1	Description of the community's/organization's vision of itself as a result of implementing the plan	0/1	to lessen the impact disasters, have on life and property has the statement, does not imply how it wants to VIEW itself later
Hazard Analysis	1/1	Process used to identify hazards explained	5/6	Likely adverse impact, geographic extent, frequency…pg.4
		Any assumptions/limitations associated with process to identify hazards explained		
		Potential types of hazards listed		yes
		Description of characteristics of each hazard		yes
		Mapping and/or modeling of hazards demonstrated		pg-63, 64, drought intensity and bar graphs, graph of likelihood of heat disorders p. 65, flood zone tables, p. 70
		Sources of data described (multiple sources referred to)		Yes, p. 58, FEMA, NOAA, NWS and many more, FEMA flood insurance rate maps,

The above example shows that the plan had a vision statement; ‘to lessen the impacts of disasters have on life and property.’ This qualified for an inclusion point. However, this did not meet the criteria for comprehensiveness as it did not accurately denote the vision after the implementation of the plan. Hence, resulting in 0 points for comprehensiveness. In the same example, it received a point for the inclusion of the hazard analysis component. However, it only addressed 5 out of 6 sub-elements, hence resulting in 5 points for comprehensiveness.

Figure 2 shows the inclusion and comprehensiveness score of the scope component. This example is taken from Marathon County, Wisconsin.

In Figure 2, it can be seen that the plan received a point for inclusion as the plan did talk something about the scope. However, the comprehensiveness score showed that the plan had only addressed 3 out of 8 sub-elements of scope, missing on the remaining 5.

The number of counties that addressed each of the sub-elements for each of the components varied greatly. Appendix B shows the number of counties that addressed each element for each component included in their county plans. Different results were found for each component, which is discussed following Figure 2.

Figure 2

Comprehensiveness Score Evaluation 2

Component & Sub-Components	Inclusio	Specific Planning Elements Assessed	Compr	Comments
Scope	1/1	Plan assumptions identified Description of plan horizon Description of plan development structure role Description of plan development structure responsibilities Description of plan development structure relationships	3/8	
		Descriptions of geographic limitations of plan		1,584 square miles of entire county
		Description of administrative limitations of plan		Participating jurisdictions listed in p. 12-13
		Statement of how this plan fits with other jurisdictional/ organizational AND emergency management plans		"Every time an Emergency Management Plan is developed, updated or revised it should be referenced to the Hazard Mitigation Plan, or the Hazard Mitigation Plan referenced to the local 'Plan' to see if either of them needs modification. Using this process, new hazards may be identified and or new strategies may be developed to eliminate or reduce risks. Incorporable in Marathon County and municipal comprehensive plan "

Vision

Vision was one of the rarely included components of the plan. Only 4 out of 30 plans had framed visionary statements for their plans. Among them, only 2 of them complied with its corresponding planning element or sub-component. While the other two plans did include a

vision statement, but they failed to fit with the description as their vision of themselves after implementing the plan.

Goals

A total of 29 plans had included goals component in their plans. Four among those 29 plans addressed the first element, which was having goals that were directed towards the vision. Since 4 of the plans had a vision or a visionary statement, only those four complied with this element. Next, six plans addressed sustainability or resilience, complying with the component's second plan element. On the other hand, 25 of them complied with the third element, having future-oriented goals and useful for framing the policies.

Objectives

A total of 13 plans had included objectives in their plans. Among them, 11 of the plans had their objectives directed towards fulfilling goals, 11 had specific objectives, 10 had measurable objectives, 13 had attainable objectives, and 13 had realistic objectives. However, none of them had the time-bound objectives.

Scope

Scope was found to be included in all 30 plans. However, comprehensiveness analysis showed that the elements plans addressed for Scope varied greatly. The elements that were addressed in the majority of the plans were the description of administrative limitations (26 plans), statement of how the plan fitted with other plans (15 plans), description of plans horizon (12 plans), and the geographic limitation of the plan (11 plans). The least included elements were plan assumptions (3 plans), plan development structure roles (5 plans), plan development structure responsibilities (3 plans), and their relationships (2 plans).

Planning process

Planning process was also one of the components that were included in all plans. However, like Scope, this component's comprehensive analysis also showed that its elements were addressed varied to a great extent. The majority of the plans had a description of group/individuals involved in making the plan (29 plans), the description of the frequency of contact (27 plans), and the description of techniques used for getting information from the stakeholders (27 plans). On the other hand, the least included elements were the description of the number involved (2 plans), description of the number of techniques for providing information to stakeholders (4 plans), and description of how stakeholders influenced the process (4 plans). The remaining elements were addressed in a variable amount in between.

Legal foundation

A total of 29 plans included this component. Among them, 17 had the description of authority to the plan, 15 had the description of duty to the plan, and 22 had the descriptions of standards referred to in the process of plan development.

Hazard analysis

Hazard analysis was also included in all the 30 plans. All the plans had listed the potential type of hazard, and 29 had the description of the characteristics. The other remaining elements were also extensively addressed by the plans, except for the assumptions/limitations associated with the process to identify hazards, which was only included by eight plans.

Vulnerability analysis

A total of 28 plans had included Vulnerability analysis. Among them, the number of plans that addressed each of the elements varied. The majority of the plans had assessed economic vulnerabilities (27 plans), had data informed assessment of those economic

vulnerabilities (23 plans), and had those assessment based on reliable data (20 plans). 22 plans had the geographic vulnerabilities assessed. 11 had the data-informed assessment, and 10 had those assessments based on reliable data. 19 plans had social vulnerabilities assessed, among which seven had the data-informed assessment, and 6 had the assessment based on reliable data. 11 plans had addressed or taken account of the special needs appropriate to the plan type. Lastly, 15 plans described the assessment process, while 6 had the assumptions/limitations explained in identifying the vulnerabilities.

Risk assessment

All 30 plans had included risk assessment in their plans. Among them, the majority of the plans had the direct impact assessed (29 plans), likelihood established (28 plans), data-informed assessment (27 plans), assessment based on reliable data (25 plans), and hazards prioritized/ranked (25 plans). 22 plans had explained the process to assess risk, and 9 had the assumptions/limitations associated with identifying risk explained. Few plans (10 plans) had included the indirect impact, while only one plan had the relationship of hazard, vulnerability, and risk processes to the planning described.

Plan testing

This was the least included component throughout the plan. Only one plan had included this component while addressing three elements of this. They were schedule of periodic ongoing exercise, identification of the targets for the exercise, and identification of what will be tested in the exercise.

Plan maintenance

A total of 27 plans had this component included in their plans. 17 plans had specified the time frame for the plan reviewing. 26 plans specified time frame for plan revision, while 26 plans

also had the description of the plan maintenance. These 26, however, not being the same plan necessarily.

Plan implementation

A total of 29 plans had included this element. Among them, 28 identified the responsibility for the implementation, 26 identified the financial resources, while only 13 identified the human resources. Likewise, 10 plans had the description of how the evaluation will be handled, including indicators, 7 had the identification of the technical resources, 8 had included the discussion of how resources will be acquired, and; lastly, two plans had the inclusion of the flexibility statement.

Definitions

A total of 24 plans had included definitions in their plans. Those 24 had the definitions of the required key terms, phrases also including policies and provisions.

The total Comprehensiveness score for each county's Base plan components was also calculated along with the component-wise analysis. Table 7 shows the summary of the Comprehensiveness of all the base plan components of all 30 counties.

Table 7

Comprehensiveness Score Summary of All Counties for Base Plan

County	State	Comprehensiveness Score (out of 76)
Cass	ND	53
Cook	IL	51
Dakota	MN	43
Milwaukee	WI	43
Woodbury	IA	41
Sangamon	IL	41
Champaign	IL	39
Washington	MN	39
Black Hawk	IA	38
Hennepin	MN	37
Winnebago	IL	35
Scott	MN	35
DuPage	IL	34
Dekalb	IL	34
Ramsey	MN	34
Kankakee	IL	33
Sheboygan	WI	33
Kendall	IL	32
Macon	IL	32
Olmsted	MN	32
Carver	MN	32
St. Louis	MN	30
Fond Du Lac	WI	29
Marathon	WI	29
Linn	IA	28
Johnson	IA	27
Anoka	MN	27
Outagamie	WI	26
La Crosse	WI	25
Dane	WI	12

The comprehensiveness score varied significantly across the counties. Out of 76 points, the scores ranged from 12 being lowest to 53 being the highest. Dane County in Wisconsin obtained the lowest score, and the highest was obtained by Cass County in North Dakota. Even though plans seemed to address most of the elements, this variation in comprehensiveness scores showed that not all the elements were identified enough to address them.

Internal compatibility

The following quality characteristic examined in the base plans was internal compatibility. It was evaluated out of 2 points. The components having better internal compatibility, meaning, information, and explanation consistent and compatible with the plan type, received full 2 points. On the other hand, lack of such consistency and compatibility resulted in the loss of points. Some examples of the components that qualified for the full points are presented below. Figure 3 shows an example of a good internal compatibility score. The example is taken from Black Hawk County, Iowa.

In this example, the plan has addressed 5 out of 6 elements of the corresponding component. The information for each identified element was consistently built and was grounded within their described process. Also, the sources of the data and the mapping and modeling were county specific so as to build onto the potential hazard that could affect the county in particular. This, overall, made the component qualify for a full score in internal compatibility.

Figure 3

Good Internal Compatibility Score 1

Component & Sub-Components	Inclusion	Specific Planning Elements Assessed	Compr.	Intern. Compa.	Comments
Hazard Analysis	1/1	Process used to identify hazards explained	5/6	2/2	hazards that pose a risk to the entire planning area, as well as unique hazards for each jurisdiction, were reviewed, identified, and updated. Second, an updated assessment of the hazards was conducted that took into account historic occurrence, the number of people that would be or were impacted, the area of the planning area that was or would be affected, potential costs that the planning area, individuals, and organization have or may incur, the likelihood of future occurrence, and the amount of warning time before and event occurs. …p. 6 the 2010 Iowa Hazard Mitigation Plan, and the contractual agreement between the County and FEMA. Additional hazards were also identified based on their occurrence since the previously approved plans were adopted or may occur in the next five years. Hazards were considered for elimination if there was no historical occurrence and Committee members determined there was no chance of occurrence in the future…. p. 19
		Any assumptions/limitations associated with process to identify hazards explained			
		Potential types of hazards listed			Yes
		Description of characteristics of each hazard			Described for each
		Mapping and/or modeling of hazards demonstrated			Dam failure, levee failure floodplain map, flood scenario map, flood map for main cities, tornado scenario maps, critical sites maps
		Sources of data described (multiple sources referred to)			previous and current hazard mitigation plan, available data from the National Climatic Data Center, the State of Iowa updated HMP and other available data from the county and incorporated communities. p. 21

Another example of a good internal compatibility score can be taken from the scope component of Carver County, Minnesota.

Figure 4

Good Internal Compatibility Score 2

Component & Sub-Components	**Inclusio -**	**Specific Planning Elements Assessed**	**Compr**	**Intern. Compa**	Comments
Scope	1/1	Plan assumptions identified Description of plan horizon Description of plan development structure role Description of plan development structure responsibilities Description of plan development structure relationships Descriptions of geographic limitations of plan Description of administrative limitations of plan	4/8	2/2	5 years scope The whole Carver County area Listed participating municipalities in ES-1 of summary. also listed cities and townships
		Statement of how this plan fits with other jurisdictional/ organizational AND emergency management plans			Integrating the requirements of this plan into other: Comprehensive plans, Strategic plans, Capital improvement plans, Growth management plans, Ordinances, resolutions, and regulations, Continuity of operations plans

In this example, the component received a point for inclusion and four comprehensiveness points for addressing four elements. It received 2 points for internal compatibility because the four elements addressed were consistent throughout the plan and built into the Scope information grounded to the county. The missing elements made it lose points for comprehensiveness and perhaps clarity. However, the provided element and their information did fit for the consistent building of the plan.

Some components also received a score of 1 for internal compatibility. The examples of such scores are assessed to understand the cases for decreased internal compatibility score. The following example is taken from Hennepin County, Minnesota.

Figure 5

Bad Internal Compatibility Score 1

Component & Sub-Components	**Inclusio** --	**Specific Planning Elements Assessed**	**Compr**	**Intern. Compa**	Comments
Objectives	1/1	Objectives are directed toward fulfilling goals Objectives are specific Objectives are measurable Objectives are attainable Objectives are realistic Objectives are time-bound	3/6	1/2	Not really. Objectives are not compatible with corresponding goals. Multiple cases

In this example, the objective component received one score for internal compatibility. Here, the listed objectives for the specific goals did not go together. For instance, they had a goal of protecting natural resources for which their listed objectives were stormwater planning and maintaining protective structures. These objectives did not fit the stated goals. Had they allocated a specific goal in terms of structural tool perspective; these objectives would fit there. However, from a natural resource protection view, these objectives were not likely to serve the purpose. Similar cases of incompatible goals and objectives were encountered for this county, which resulted in a deduction of 1 point for internal compatibility.

Another example of a lower internal compatibility score can be seen in the hazard analysis component of Scott County, Minnesota. Figure 6 illustrates this.

Figure 6

Bad Internal Compatibility Score 2

Component & Sub-Components	Inclusio --	Specific Planning Elements Assessed	Compr	Intern. Compa	Comments
Hazard Analysis	1/1	Process used to identify hazards explained	5/6	1/2	past occurrences and sources of information like NWS, sate mitigation plans, geological data
		Any assumptions/limitations associated with process to identify hazards explained			
		Potential types of hazards listed			yes
		Description of characteristics of each hazard			yes, but a lot of them explained in terms of Minnesota rather than in terms of County, which fails to provide a definite picture for the county
		Mapping and/or modeling of hazards demonstrated			mostly but provided of entire state or entire US at times rather than county specific…
		Sources of data described (multiple sources referred to)			USGS and state mostly

In this example, the hazard analysis received a point for Inclusion and 5 points for comprehensiveness by addressing the 5 elements of the component. However, it received only 1 point for internal compatibility because the analysis was not county specific. Despite formulating the plan in terms of the county, the plan did not make the hazard analysis at the same level. County is one of the many parts of the State, and it is plausible that the State's major threats can be the major threats of this county too. However, facts like the area of the county, its situation in the State, also play a role in differing some specific hazard information. Inherently, the concern here was the closer look at this county rather than a broad assumption made in terms of its State. Therefore, the analysis did not serve its purpose to full extent, resulting in the internal compatibility score of 1.

The other bad score cases were losing the whole 2 points and receiving a score of 0. This was majorly due to missing of the main component. For instance, the lack of vision component in most of the plans resulted in lack of its Inclusion score, followed by comprehensiveness score and internal compatibility. Figure 7 illustrates this example. The example is taken from Sheboygan County, Wisconsin.

Figure 7

Bad Internal Compatibility Score 3

Component & Sub-Components	**Inclusio-**	**Specific Planning Elements Assessed**	**Compr**	**Intern. Compa**	Comments
Vision	0/1	Description of the community's/organization's vision of itself as a result of implementing the plan	0/1	0/2	Vision statement absent in the plan. Hence, 0 points for all.

The Final detailed Score Chart in Appendix B shows the distribution of internal compatibility scores throughout each plan component. It shows that for most of the components that were included in the plans, they earned a full score for internal compatibility.

Likewise, county-wise internal compatibility scores were also noted, showing the total internal compatibility scores earned by plans across all Base plan components. Table 8 below shows the summary of total internal compatibility scores of base plan components earned by all 30 counties.

Table 8

Internal Compatibility Score Summary of All Counties for Base Plan

County	State	Internal Compatibility Score (out of 26)
Cook	IL	23
Woodbury	IA	22
Winnebago	IL	22
Kankakee	IL	22
Washington	MN	22
Cass	ND	22
Milwaukee	WI	22
Champaign	IL	21
Kendall	IL	21
St. Louis	MN	21
Scott	MN	21
Johnson	IA	20
Black Hawk	IA	20
Sangamon	IL	20
DuPage	IL	20
Dekalb	IL	20
Ramsey	MN	20
Olmsted	MN	20
Fond Du Lac	WI	20
La Crosse	WI	20
Hennepin	MN	19
Linn	IA	18
Macon	IL	18
Dakota	MN	18
Carver	MN	18
Outagamie	WI	18
Sheboygan	WI	18
Marathon	WI	18
Anoka	MN	16
Dane	WI	12

The total internal compatibility score ranged from 12 to 23. The highest score was obtained by Cook County in Illinois, while the lowest was obtained by Dane County in Wisconsin. It was evident how the loss of inclusion points subsequently resulted in a low comprehensiveness score as well as a low internal compatibility score, as seen in Dane County.

Furthermore, gain in inclusion points also favored the gain of comprehensiveness and internal compatibility score, as seen in Cook County.

Clarity

The last evaluation characteristic was clarity. This characteristic checked whether the plan was easily comprehended, clearly written, and supported by evidence. It was evaluated out of 2 points. If the plan component was easy to comprehend, was written in simple language, and was backed by evidence wherever possible, the component qualified for full 2 points. However, if they lacked these traits, then this resulted in a loss of points. Figure 8 illustrates the case of a good clarity score. The example is taken from Washington County, Minnesota.

Figure 8

Good Clarity Score 1

Component & Sub-Components	Inclusion	Specific Planning Elements Assessed	Compr	Intern Comp	Clarity	Comments
Plan Maintenance	1/1	Specifies time frame on an ongoing basis in which the plan will be reviewed Specifies time frame on an ongoing basis in which the plan will be revised Describes process by which maintenance will be conducted	3/3	2/2	2/2	over a three-year timeframe. p. 4 The five-year update will be done in accordance with FEMA guidelines. The process will be inclusive of a variety of local stakeholders, will continue to make use of the existing Washington County Emergency Management Council, and will include the general public as well. The plan will be reviewed, updated, and submitted to the Minnesota Division of Homeland Security and Emergency Management and FEMA along with the Washington County Board of Commissioners every five years for approval. Given past example: The updated plan was submitted to the State of Minnesota Mitigation Officer for review in September 2018. Upon recommendation of the Mitigation Officer, the Washington County All Hazard Mitigation Plan was then sent to FEMA for review. When all necessary alterations have been made from feedback received from FEMA, resolutions of approval from the county, cities, and townships will be sought for their official inclusion in the Washington County All-Hazard Mitigation Plan.

In this example, the plan addressed all three elements of the component and stated and described them specifically and clearly. It was free from jargon, ambiguity, and also included an example of the past process. Hence, it received full points for clarity.

The next example also illustrates the case of a good clarity score. The example was taken from Macon County, Illinois.

Figure 9

Good Clarity Score 2

Component & Sub-Components	**Inclusio**	**Specific Planning Elements Assessed**	**Compr**	**Intern. Compa**	**Clarit**	Comments
Plan Implement	1/1	Responsibility for implementation identified	5/7	2/2	2/2	Responsible agencies identified in appendix E
		Identification of human resources acquired				stated that resources and personnel were authorized and committed by chief elected officials…p. 8
		Identification of financial resources required				stated in table, appendix E
		Identification of technical resources required				
		Discussion of how resources will be acquired				described various grants and programs from where the resources could be achieved
		Description of how evaluation will be handled including indicators				not only include checking the implementation status of mitigation actions, but also assessing their degree of effectiveness and assessing whether other natural hazards need to be addressed, check goals, mitigation actions need to be discontinued or modified in light of new developments
						also complying with public comment
		Inclusion of flexibility statement				

In the above example, the plan addressed 5 elements out of 7 for the plan implementation component, missing the other two components. Hence it lost two points in the comprehensiveness score. However, the plan provided the information on other elements with detail and clarity, building well onto the plan implementation section. Therefore, it qualified for a full score in clarity.

Some components also received a score of 1 for clarity. The examples of such scores are assessed to understand the cases for decreased clarity score. The following example is taken from Fond Du Lac County, Wisconsin.

Figure 10

Bad Clarity Score 1

Component & Sub-Components	Inclusio	Specific Planning Elements Assessed	Compr	Intern. Compa	Clarity	Comments
		Process used to identify hazards explained				historical hazard occurrences data from the National Oceanic and Atmospheric Administration (NOAA) National Climatic Data Center (NCDC).
Hazard Analysis	1/1		4/6	2/2	1/2	
		Any assumptions/limitations associated with process to identify hazards explained				The FEMA HAZUS software was not utilized due to the availability of current local data and numerous differences between census boundaries and locally available map features.
		Potential types of hazards listed				Yes
		Description of characteristics of each hazard				Yes
		Mapping and/or modeling of hazards demonstrated				Not included
		Sources of data described (multiple sources referred to)				No

In this example, the plan included the hazard analysis component and addressed four elements out of 6. However, it missed the last 2 elements that resulted in the loss of some comprehensiveness as well as clarity score. Mapping and modeling are an important aspect of hazard analysis. It helps to understand the nature of the hazard better and get a better picture of it. Missing of this element affected the clarity of the analysis. Likewise, lack of description of the data sources led to the missing of evidence instilling skeptics about the information presented. Therefore, the component was awarded only one point for clarity.

Another example of a lower clarity score can be seen in plan implementation component of St. Louis County, Minnesota. Figure 11 illustrates this.

Figure 11

Bad Clarity Score 2

Component & Sub-Components	Inclusio	Specific Planning Elements Assessed	Compr	Intern. Compa	Clarity	Comments
Plan Implement	1/1	Responsibility for implementation identified Identification of human resources acquired Identification of financial resources required Identification of technical resources required Discussion of how resources will be acquired Description of how evaluation will be handled including indicators Inclusion of flexibility statement	1/7	1/2	1/2	Local governments carry the primary responsibility to implement and coordinate the implementation of each strategy. p. 14, also in goals, objective, strategies table, Talked about grants in the initial part of the plan…but did not clearly state any though

In this example, the plan only addressed one element of the plan implementation component, hence receiving 1 point for comprehensiveness. For the third element, 'Identification of financial resources required,' the plan initially talked about some grants. However, it did not expand or presented any consistent information in the rest of the plan. This ultimately resulted in the loss of internal compatibility points, followed by clarity. The component was not addressed clearly, which did not help provide a better picture.

The other cases of bad scores were losing the whole 2 points and receiving a score of 0. This was majorly due to missing of the main component. For instance, lack of plan testing component in most of the plans resulted in lack of its inclusion score, followed by comprehensiveness score, internal compatibility, and eventually clarity. Figure 12 illustrates this example. The example is taken from Linn County, Iowa.

Figure 12

Bad Clarity Score 3

Component & Sub-Components	**Inclusio**	**Specific Planning Elements Assessed**	**Compr**	**Intern. Compa**	**Clarity**	Comments
Plan Testing	0/1	Schedule of periodic ongoing training Identification of who will be targeted in training Identification of the purpose of training Identification of how feedback will be provided and incorporated from exercises Schedule of periodic ongoing exercise (if applicable) Identification of who will be targeted in exercises Identification of what will be tested in exercises Identification of how feedback will be provided and incorporated from exercises	0/8	0/2	0/2	No inclusion of the element at all.

The above example is easy to comprehend as it can be inferred that lack of inclusion of the component resulted in null scores for all quality characteristics, including clarity.

The Final detailed Score Chart in Appendix B shows the distribution of clarity scores throughout each plan component. It shows that for most of the components that were included in the plans, they earned moderate to the full score for clarity.

Likewise, county-wise clarity scores were also noted, showing the total clarity scores earned by plans across all base plan components. Table 9 below shows the summary of total clarity scores of base plan components earned by all 30 counties.

Table 9

Clarity Score Summary of All Counties for Base Plan Components

County	State	Clarity Score (out of 26)
Cook	IL	24
Cass	ND	22
Kendall	IL	21
Milwaukee	WI	21
Woodbury	IA	20
Winnebago	IL	20
Champaign	IL	20
Ramsey	MN	20
Olmsted	MN	20
Scott	MN	20
Black Hawk	IA	19
Sangamon	IL	19
Kankakee	IL	19
DuPage	IL	19
St. Louis	MN	19
Washington	MN	19
Fond Du Lac	WI	19
Johnson	IA	18
Dekalb	IL	18
Hennepin	MN	16
Dakota	MN	17
Outagamie	WI	17
Sheboygan	WI	17
Marathon	WI	17
Macon	IL	16
Linn	IA	15
La Crosse	WI	15
Anoka	MN	14
Carver	MN	14
Dane	WI	10

The clarity score ranged from 10 to 24. Again, the highest being Cook County, Illinois, and lowest being Dane County, Wisconsin. Similar to internal compatibility, much of the loss was attributed to missing components whose clarity score went automatically zero. Besides, the lack of adequate information and pieces of evidence also affected in some cases. Better inclusion and comprehensiveness scores favored for better clarity.

Mitigation Specific Component Score

A total of 8 components were evaluated in the mitigation specific section as described and tabled in Chapter 2. Like the base plan components, these mitigation specific components were also scored based on 4 quality characteristics; inclusion, comprehensiveness, internal compatibility, and clarity. This section details the evaluation scores based on these criteria for these eight mitigation specific components.

Inclusion

A thorough assessment of the plan helped in ensuring if the mitigation specific components of the plan were included or not. Plans received a score if the specific component's inclusion was detected and were scored null if they lacked. The following example illustrates the assignment of the inclusion points for the Mitigation Specific components. The example is taken from Dane County, Wisconsin.

Figure 13

Assignment of Inclusion Score (Mitigation Specific)

Mitigation Plan Components	Inclusion	List of Tools/Choices	Comments
Incentive based tools	0/1	Maximization of tools given primary hazards faced. No tools given primary hazards faced=0, 1 or more, but not all= 1, all given hazards= 2. List of choices: Land and property acquisition, retrofitting private structures, tax abatement for mitigation, density bonus, low interest loans, NFIP, others	
Structural tools	1/1	Maximization of tools given primary hazards faced. No tools given primary hazards faced=0, 1 or more, but not all= 1, all given hazards= 2. List of choices: levees, seawalls, riprap or bulkheads, detention ponds,	Develop a coordinated management strategy and a unified plan of operation and maintenance for all control structures on the Yahaira River from Tenneh Dam to the Stebbins Ville Dam. Assure that the responsible agency has the technical expertise and resources to operate and maintain the control structures within the parameters of the plan. Evaluate methods such as modification of bridge constrictions, aquatic plant removal, dredging, and channel modifications to increase flow conveyance, while respecting in-stream natural and cultural resources.
		channel maintenance, slope stabilization, storm water management, sewage/drainage management, maintenance of structures, others	Evaluate stormwater volume control policies, such as a 100% pre-development run- off control ordinance and fee-in-lieu-of program and assess for feasibility both County-wide and in closed watersheds only, Work with stormwater utilities to create public outreach campaign to educate public on benefits of stormwater volume control techniques and water conservation. Highlight property owner opportunities to contribute to increased volume control such as rain gardens and rain barrels or cisterns. Evaluate methods such as modification of bridge constrictions, aquatic plant removal, dredging, and channel modifications to increase flow conveyance, while respecting in-stream natural and cultural resources. install natural barriers beside highways and other roads, and re-grade roadsides to decrease snow on roads focusing on residential developments with limited road access

In this example, the plan did not consider any of the incentive-based tools provided. This resulted in 0 scores for inclusion of incentive-based tools. On the other hand, the plan had taken account of various mitigation strategies and actions pertaining to the structural tools component. Hence, the plan qualified for an inclusion point for structural tools.

First, the component-wise analysis was done. Here, the number of counties was noted that included each of the mitigation specific components in their plan. Table 10 below shows the summary of this result.

Table 10

Number of Counties Including Each of the Mitigation Specific Components

Mitigation Specific Components	Number of Counties that included them (out of 30)
Regulatory Tools for Hazard Zone	30
Structural Tools	30
Public Facilities and Infrastructure	30
Awareness/Educational Tools	30
Incentive Based Tools	29
General Policy	28
Modeling Techniques and Tools	21
Natural Resource Protection	17

This information can also be assessed from the Final Detailed Score Chart in Appendix B. It was found that the natural resource protection and modeling technique and tools were less included in the plans compared to the rest of the components.

Likewise, the total inclusion scores for the mitigation components received by each of the counties were also noted. Table 11 below shows the summary of total inclusion scores of mitigation specific components for all 30 counties.

Table 11

Inclusion Scores Summary of All Counties for Mitigation Specific Components

County	State	Inclusion Score (out of 8)
Black Hawk	IA	8
Cook	IL	8
Dekalb	IL	8
DuPage	IL	8
Anoka	MN	8
Hennepin	MN	8
Olmsted	MN	8
Scott	MN	8
St. Louis	MN	8
Washington	MN	8
La Crosse	WI	8
Milwaukee	WI	8
Johnson	IA	7
Kankakee	IL	7
Kendall	IL	7
Winnebago	IL	7
Carver	MN	7
Dakota	MN	7
Ramsey	MN	7
Dane	WI	7
Fond Du Lac	WI	7
Outagamie	WI	7
Sheboygan	WI	7
Linn	IA	6
Woodbury	IA	6
Champaign	IL	6
Macon	IL	6
Sangamon	IL	6
Cass	ND	6
Marathon	WI	6

The inclusion score ranged from 6 to 8, denoting that plans had at least included 6 or more components. 12 counties scored full 8 in inclusion. 11 of them scored 7 while the rest scored 6.

Comprehensiveness

Comprehensiveness stood as the most important quality characteristics for mitigation specific components. This characteristic accounted for the policies, projects and strategies that the counties considered in their mitigation plans. This demonstrated the range of tool choices the counties made for each component and to what extent their optimization occurred. It was evaluated out of 2 points. If the plans included all the tools provided for the component, ensuring full maximization, they could receive full points. If they included one or more of them, they qualified for a single point and, lastly, received no points if they had no tools included. Examples are illustrated to clarify these assignments of scores. Figure 14 shows the component that qualified for full points for comprehensiveness. The example is taken from Winnebago County, Illinois.

Figure 14

Good Comprehensiveness Score 1 (Mitigation Specific)

Mitigation Plan Components	**Inclusio**	List of Tools/Choices	**Compr**	Comments
General Policy	1/1	Discourage hazardous area development	2/2	Reducing floodplain development crucial to reducing flood-related damages, p. 45, p. 81, Community development should occur outside of the low-lying areas in floodplains with a water table within five feet of grade that is susceptible to liquefaction.
		Support adoption of new regulatory legislation at local level		Review and update existing, or create new, community plans and ordinances to support hazard mitigation, p. 102

In this example, the plan included the component and addressed both the choices provided for the component in their mitigation strategy. Thus, they ultimately qualified for full

points in comprehensiveness. Another example of a good comprehensiveness score is shown below. This example is taken from Olmsted County, Minnesota.

Figure 15

Good Comprehensiveness Score 2 (Mitigation Specific)

Mitigation Plan Components	**Inclusio**	List of Tools/Choices	**Compr**	Comments
Public facilities and infrastructure	1/1	Maximization of tools given primary hazards faced. No tools given primary hazards faced=0, 1 or more, but not all= 1, all given hazards= 2. List of choices: capital improvement plans, retrofitting public structure, retrofitting critical facilities, others	2/2	capital improvement plans for flood, evaluate for construction or retrofit of safe rooms or storm shelters, identify aboveground power lines vulnerable to failure during severe ice storm or wind events and work with public utilities to evaluate/implement mitigation projects such as hardening or burying of power lines as needed, p. 114 striving for road and culvert improvements, burying powerlines necessary during severe storms, Critical facilities in the county and cities that care for vulnerable populations (such as schools and nursing homes) should be encouraged to have air conditioning for extreme heat hazard, *Federal Emergency Management Agency (FEMA) National Dam Safety Program,* Identify critical facilities that do not have backup power in the event of a major power outage, p. 112, Purchase and install generators or related equipment (e.g., generator hook-ups) for identified critical facilities that require backup power, p. 113, Implement required flood mitigation measures for roads, bridges, and culverts (i.e., raising roads, installation or modification of culverts, creation of retention areas.), identify rural areas vulnerable to wildfire and not in proximity to a water source to assist in fire suppression. Evaluate projects such as installation of underground water tanks to help assist fire departments if needed, encourage public or private property owners (such as landowners, parks or campgrounds) to incorporate defensible space and fuels reduction around new or existing structures that may be at-risk of wildfire

In this example, the plan took account of all the tools listed for the component. This demonstrated the maximization of possible tools for coping with their major hazard in terms of the corresponding component, which, in this case, is public facilities and infrastructure. Hence, it qualified for full points in comprehensiveness.

Plans received 1 point for comprehensiveness more frequently (See Appendix B). Examples of such scores are illustrated below in Figure 16 and 17. Figure 16 is taken from Champaign County, Illinois.

Figure 16

Bad Comprehensiveness Score 1 (Mitigation Specific)

Mitigation Plan Components	**Inclusion**	List of Tools/Choices	**Compre**.	Comments
Structural tools	1/1	Maximization of tools given primary hazards faced. No tools given primary hazards faced=0, 1 or more, but not all= 1, all given hazards= 2. List of choices: levees, seawalls, riprap or bulkheads, detention ponds, channel maintenance, slope stabilization, storm water management, sewage/drainage management, maintenance of structures, others	1/2	Stormwater Management Regulations in Subdivision Ordinance, Stormwater Management Regulations in Municipal Code, adequate stormwater detention facilities in the Boneyard Creek watershed. Conduct volunteer clean-up of Boneyard Creek as part of the MS4 Stormwater Management Program Biannual Community Cleanup Day event, require construction of detention basins in accordance with City stormwater regulations, erosion control plans for in accordance to stormwater regulations Drainage Improvement Project installation of a 60-inch storm sewer between Prairie Street and State Street, prioritize and oversee drainage improvements.

In this example, the plan only took account of the stormwater management tools/actions and sewage/drainage management in terms of the structural tools component. It did not address the other choices offered in this component that could aid in their mitigation. Hence, it only qualified for a single point. The next example of a similar case is taken from Cass County, North Dakota.

Figure 17

Bad Comprehensiveness Score 2 (Mitigation Specific)

Mitigation Plan Components	**Inclusion**	List of Tools/Choices	**Compre**.	Comments
Regulatory tools for hazard zone	1 /1	Maximization of tools given primary hazards faced. No tools given primary hazards faced=0, 1 or more, but not all= 1, all given hazards= 2. List of choices: Permitted land use, low density conservation, overlay zone with reduced density provisions, open space dedications, policy to locate public facilities to non-hazardous area, development rights transferred, cluster developments, setbacks, site plan review, special study/impact assessment of development, building standards/codes, land and property acquisition, impact fees, special assessments, retrofitting of private structure, relocation of structures out of hazard zones, drainage ordinance, zoning, Nonconforming use regulations, Subdivision ordinance, differential taxation, Limiting services to areas, Floodplain regulation including management, development ordinance and down zoning, Others	1/2	structures removed or relocated and were turned into restored habitats and park facilities, p. 106, Considered keeping Setbacks, identified importance of educating and complying to building codes Acquisition of flood and landslide area, p. 106, 108 Retrofitting private structures, p. 104, 154 Relocate lift station and install permanent generator…p. 164, 166 Zoning considered significantly Prioritized floodplain regulations and management

In this example, the county has identified and included various regulatory tools aiding in its mitigation endeavor. However, they have still missed the rest of the tools offered in this component, making them receive a single point for comprehensiveness.

Apart from this, plans also received 0 points for comprehensiveness. However, this was only in cases where the inclusion score was 0 in the first place. This is illustrated in Figure 18, which is taken from Kankakee County, Illinois.

Figure 18

Bad Comprehensiveness Score 3 (Mitigation Specific)

Mitigation Plan Components	**Inclusion**	List of Tools/Choices	**Compre**.	Comments
Natural resource protection	0/1	Maximization of tools given primary hazards faced. No tools given primary hazards faced=0, 1 or more, but not all= 1, all given hazards= 2. List of choices: general description of best management practice, forest and vegetation management of riparian areas, sediment and erosion control, stream dumping regulations, urban forestry and landscapes, soil conservation and steep slope preservation, dune preservation, wetland protection and preservation, other	0/2	Did not include anything related to this component.

In this example, it is evident that the comprehensive score is 0 as the inclusion score is 0 in the first place. The plan did not consider any of the natural resource protection component tools, resulting in a null score for the subsequent quality characteristics.

The Final detailed Score Distribution Chart in Appendix B shows the distribution of comprehensiveness scores throughout each specific mitigation components. It shows that for most of the components that were included in the plans, they earned a score of 1 for comprehensiveness.

Likewise, county-wise comprehensiveness scores were also noted, showing the total comprehensiveness scores earned by counties across all Mitigation Specific components. Table 12 below shows the summary of total comprehensiveness scores of mitigation specific components earned by all 30 counties.

Table 12

Comprehensiveness Scores Summary of All Counties for Mitigation Specific Components

County	State	Comprehensiveness Score (out of 16)
Hennepin	MN	10
Black Hawk	IA	9
DuPage	IL	9
Cook	IL	9
Dekalb	IL	9
Anoka	MN	9
St. Louis	MN	9
Olmsted	MN	9
Scott	MN	9
La Crosse	WI	9
Milwaukee	WI	9
Winnebago	IL	8
Kendall	IL	8
Kankakee	IL	8
Washington	MN	8
Sheboygan	WI	8
Johnson	IA	7
Woodbury	IA	7
Champaign	IL	7
Dakota	MN	7
Ramsey	MN	7
Carver	MN	7
Cass	ND	7
Dane	WI	7
Fond Du Lac	WI	7
Outagamie	WI	7
Marathon	WI	7
Linn	IA	6
Sangamon	IL	6
Macon	IL	6

The comprehensiveness scores ranged from 6 to 10 out of 16. This was attributed to the fact that plans mostly considered some or few tools for each component, making them gain half scores for most components.

Internal compatibility

For mitigation specific components, plans were considered internally compatible if there was connectedness between the mitigation strategies and hazard identified; if there was a tie-up between the identified issues and the solutions/ideas presented that fitted with the county's context and scenario. It was evaluated out of 2 points. Plans received full points if they presented logical coherence regarding their chosen actions and lost one or the whole points if failed to do so. Examples are illustrated to clarify these assignments of scores. Figure 19 shows the component that qualified for full points for internal compatibility. The example is taken from Ramsey County, Minnesota

Figure 19

Good Internal Compatibility Score 1 (Mitigation Specific)

Mitigation Plan Components	Inclusion	List of Tools/Choices	Compre	Intern Comp	Comments
Awareness/educational tools	1/1	Maximization of tools given primary hazards faced. No tools given primary hazards faced=0, 1 or more, but not all= 1, all given hazards= 2. List of choices: education/training opportunities for community, staff, private stakeholders and students Maximization of tools given primary hazards faced. No tools given primary hazards faced=0, 1 or more, but not all= 1, all given hazards= 2. List of choices: real estate hazard disclosure, hazard notification, maps of areas subject to hazard, disaster warnings and response programs hazardous signage and related location, technical mitigation assistance, inclusion of floodplain boundaries, workshops, education/training in several languages, hazard information center, others	1/2	2/2	*Severe Weather Awareness Week* –, Ramsey County Emergency Management and Homeland Security offers Skywarn training in conjunction with Metro Skywarn on an annual basis to local public safety personnel, Ramsey County employees and residents that wish to be trained as volunteers., presentation in school and programs Everbridge's open subscription service was made available to the public in September 2016 (https://www.ramseycounty.us/alerts), included Everbridge Mass Notification System, the Integrated Public Alert and Warning System (IPAWS), Wireless Emergency Alerts (WEA), Ramsey County Emergency Management and Homeland Security Facebook page, and local news media. …p. 46 Map of hazard area Summer storm watches, advisories, warnings are initiated by the National Weather Service. The emergency warning system is activated by the dispatch center as directed promotes the use of NOAA weather radios by critical facilities and the public to receive information broadcast from the National Weather Service. Local television & radio stations assist with sharing public information. translation services for only three languages (Spanish, Somali, and Hmong). Mailing residents in hazard prone areas.

In this example, it can be seen that the county had included a number of actions and strategies pertaining to education and awareness. These tools were appropriate in leveraging knowledge and notifying the county residents about the anticipated threat. The services were allocated at the local level identifying the needs of the county. Also, these actions were categorized according to the county's feasibility and budget while attempting to meet as many awareness/educational tools as possible. Thus, the component received a full point for internal compatibility.

Another example is also assessed to illustrate the case of a good internal compatibility score. The example is taken from Cass County, North Dakota.

Figure 20

Good Internal Compatibility Score 2 (Mitigation Specific)

Mitigation Plan Components	**Inclusio**	List of Tools/Choices	**Compr**	**Intern. Compa**	Comments
Structural tools	1/1	Maximization of tools given primary hazards faced. No tools given primary hazards faced=0, 1 or more, but not all= 1, all given hazards= 2. List of choices: levees, seawalls, riprap or bulkheads, detention ponds, channel maintenance, slope stabilization, storm water management, sewage/drainage management, maintenance of structures	1/2	2/2	Actions like raising and certifying levees Drain channel improvements throughout the country, p-109, relocating the intake screens from the side channel to the deeper center channel of the River would allow prolonged use of the Red River during drought periods…p-177, lugging or capping all sewer openings for storm water management, p. 106, installation of storm water and a storm sewer lift station, p. 117 upgrading culverts…p. 122, upgrade lift station

In this example, the county has included a certain number of actions pertaining to structural tools. Even though it did not score full points for comprehensiveness, it received a full score for internal compatibility, because, first, the plan addressed the importance of each action they included and what problem or hazard it helped to mitigate. Second, it also prioritized the actions according to the extent of hazard threat to the county, while appropriating relevant resources and support for its accomplishments. Therefore, it received full points for internal compatibility.

An additional example is also assessed to review the case of a good internal compatibility Score. The example is taken from Dakota County, Minnesota.

Figure 21

Good Internal Compatibility Score 3 (Mitigation Specific)

Mitigation Plan Components	**Inclusio**	List of Tools/Choices	**Compr**	**Intern. Compa**	Comments
Modeling techniques and tools	1/1	Maximization of tools given primary hazards faced. No tools given primary hazards faced=0, 1 or more, but not all= 1, all given hazards= 2. List of choices: GIS maps, Risk profiles, others	1/2	2/2	Continue to develop new capabilities to predict the direction and velocity of groundwater flow and surface water runoff; integrate these results in the County GIS system; and share results with appropriate users. Review existing groundwater monitoring and modeling programs and determine any needs for additional groundwater monitoring

In the above example, the plan indicates allocating specific modeling techniques for groundwater monitoring for the purpose of mitigation of drought hazard impact. As one of the prominent hazards faced by the county, it was logical to address these modeling tools to cope

with the hazard and reduce its impacts. However, the plan also employed modified STAPLEE criteria to evaluate the strategies against 7 areas of consideration; Social, Technical, Administrative, Political, Legal, Economic, and Environmental (STAPLEE). This evaluation criteria were initiated by FEMA to assess the feasibility and barriers of the proposed mitigation actions helping in determining the appropriateness and priorities those actions (VÉLEZ AROCHO et al., 2019). The plan made use of the Modified STAPLEE scoring, which is tabled below.

Table 13

Modified STAPLEE Evaluation Strategies

Modified STAPLEE Scoring: 1=does not meet criteria, 2=somewhat meets criteria, or 3=meets or exceeds criteria
1. Social Impacts: community acceptance likely, benefits segment of population
2. Technical: feasible, provides long-term solution, has secondary benefits
3. Administrative: staffing available, funding allocated, maintenance/operations needs can be addressed
4. Political: political support, local champion, and public support are likely
5. Legal: state and/or local authority exists, low likelihood of legal challenges
6. Economic: beneficial, affordable, contributes to economic goals, outside funding available
7. Environmental: benefits natural resources, increases site safety, consistent with local goals and federal law

So, the action items were determined and prioritized based on their scores on the STAPLEE criteria. Thus, the plan logically established the relevance of the action and earned full points for Internal compatibility.

Plans also received a score of 1 for internal compatibility. Some examples are assessed to demonstrate such cases. The first example of such case is taken from Hennepin County, Minnesota.

Figure 22

Bad Internal Compatibility Score 1 (Mitigation Specific)

Mitigation Plan Components	Inclusio	List of Tools/Choices	Compr	Intern. Compa	Comments
Natural resource protection	1/1	Maximization of tools given primary hazards faced. No tools given primary hazards faced=0, 1 or more, but not all= 1, all given hazards= 2. List of choices: general description of best management practice,	1/2	1/2	Constructing windbreaks to prevent evaporation, collecting rainwater and using natural run offs for plants, Increasing vegetation to reduce urban heat island, buffer for dust control Flood, for climate change one, Crop rotation for drought Crop rotation for drought Contour farming, terracing, cover crops, zero and reduced tillage, Slope stabilization covered
		forest and vegetation management of riparian areas, sediment and erosion control, stream dumping regulations, urban forestry and landscapes, soil conservation and steep slope preservation, dune preservation, wetland protection and preservation, other			river restoration, grass barriers, strip cropping, or clod-producing tillage for dust control shoreline stabilization of rivers, bank stabilization, protect lakes for water quality catch basin cleaning effort each spring to reduce chances of localized flooding due to run-off or spring storms.

The plan received 1 point in internal compatibility for this component because the actions pointed out were not very feasible as per the county's scenario. Hennepin County is the most populous county in Minnesota, primarily dominated by an urban setting. With the situation of major city Minneapolis, adjacent to St. Paul, the county houses several other cities serving as the

most populous, concrete hub in the state. As such, its mitigation plan has largely addressed the tools of natural resource protection component that did not highly go with the orientation and scenario of the county. While their effort to address these tools was laudable, they failed to establish the action's relevance, like why is that tool/action significant, what problem or hazard would it address specific to the county, and how would these tools be applied. As a result, the plan lost a point on internal compatibility.

Another case of low internal compatibility is also assessed. This example is taken from Carver County, Minnesota.

Figure 23

Bad Internal Compatibility Score 2 (Mitigation Specific)

Mitigation Plan Components	**Inclusio**	List of Tools/Choices	**Compr**	**Intern. Compa**	Comments
General Policy	1/1	Discourage hazardous area development	1/2	1/2	discouragement can be inferred
		Support adoption of new regulatory legislation at local level			yes, e.g. Work with the Minnesota Department of Natural Resources (DNR) to develop state-level and county-level burning regulations.

In this example, the plan received 1 point for internal compatibility because it could be inferred from the plan that they advocated discouragement for development in the hazardous area. However, no regulation or action items were identified that supported their advocacy. Their claim was not entirely compatible with their chosen action, resulting in reduction of a point for internal compatibility.

Apart from this, plans also received 0 points for internal compatibility. However, this was only in cases where the inclusion score was 0 in the first place. This is illustrated in Figure 24, which is taken from Linn County, Iowa.

Figure 24

Bad Internal Compatibility Score 3 (Mitigation Specific)

Mitigation Plan Components	**Inclusio**	List of Tools/Choices	**Compr**	**Intern. Compa**	Comments
Natural resource protection	0/1	Maximization of tools given primary hazards faced. No tools given primary hazards faced=0, 1 or more, but not all= 1, all given hazards= 2. List of choices: general description of best management practice, forest and vegetation management of riparian areas, sediment and erosion control, stream dumping regulations, urban forestry and landscapes, soil conservation and steep slope preservation, dune preservation, wetland protection and preservation, other	/2	/2	No score for any part

In this example, the component received 0 points for inclusion in the first place. Hence the comprehensiveness score was 0, followed by internal compatibility.

The Final detailed Score Distribution Chart in Appendix B shows the distribution of internal compatibility scores throughout each specific mitigation components. It shows that for most of the components that were included in the plans, they earned a full score for internal compatibility.

Likewise, county-wise internal compatibility scores were also noted, showing the total internal compatibility scores earned by plans across mitigation specific components. Table 14

below shows the summary of total internal compatibility scores of mitigation specific components earned by all 30 counties.

Table 14

Internal Compatibility Score Summary of All Counties for Mitigation Specific Components

County	State	Internal Compatibility Score (out of 16)
Black Hawk	IA	16
DuPage	IL	16
Cook	IL	16
Dekalb	IL	16
Anoka	MN	16
St. Louis	MN	16
Washington	MN	16
Olmsted	MN	16
Scott	MN	16
La Crosse	WI	16
Milwaukee	WI	16
Hennepin	MN	15
Johnson	IA	14
Winnebago	IL	14
Kankakee	IL	14
Dakota	MN	14
Ramsey	MN	14
Dane	WI	14
Fond Du Lac	WI	14
Outagamie	WI	14
Sheboygan	WI	14
Carver	MN	13
Linn	IA	12
Woodbury	IA	12
Champaign	IL	12
Kendall	IL	12
Sangamon	IL	12
Macon	IL	12
Cass	ND	12
Marathon	WI	12

The internal compatibility score ranged from 12 to 16 out of 16. 11 counties received a full score in internal compatibility while 8 received the lowest.

Clarity

The last evaluating characteristic was clarity. This characteristic checked whether the plan was easily comprehended, clearly written, and supported by evidence. It was evaluated out of 2 points. If the mitigation specific components or the plan's actions were easy to comprehend, were written in simple language, and had provided adequate information, the component qualified for full 2 points. However, if they lacked these traits, it resulted in the loss of points. Figure 25 illustrates the case of a good clarity score. The example is taken from Ramsey County, Minnesota.

Figure 25

Good Clarity Score 1 (Mitigation Specific)

Mitigation Plan Components	Inclusio	List of Tools/Choices	Compr	Intern. Compa	Clarity	Comments
Natural resource protection	1/1	Maximization of tools given primary hazards faced. No tools given primary hazards faced=0, 1 or more, but not all= 1, all given hazards= 2. List of choices: general description of best management practice, forest and vegetation management of riparian areas, sediment and erosion control, stream dumping regulations, urban forestry and landscapes, soil conservation and steep slope preservation, dune preservation, wetland protection and preservation, other	1/2	2/2	2/2	included vegetation and forest management Watershed management organization helping in fixing erosion and moderate runoff…p. 79 assistance provided to mitigate against erosion and water quality improvement include helping landowners learn about and install measures such as raingardens, and shore land or habitat restoration, and stream or lake bank stabilization. Wetland protection and prevention identified Stream Corridor

In this example, the plan component received a full score for clarity. This was because the plan elaborated on the planning mechanism and implementation of the actions well, along with the status of the projects. The language used was simple, easy to comprehend, and free from

jargon, and the description provided was adequate. Hence, it received a full two points for clarity.

Another example is taken to illustrate a similar case of a good clarity score. The example is taken from Winnebago County, Illinois.

Figure 26

Good Clarity Score 2 (Mitigation Specific)

Mitigation Plan Components	Inclusio	List of Tools/Choices	Compr	Intern Compa	Clarity	Comments
General Policy	1/1	Discourage hazardous area development Support adoption of new regulatory legislation at local level	2/2	2/2	2/2	Reducing floodplain development is crucial to reducing flood-related damages, p. 45, p. 81, Community development should occur outside of the low-lying areas in floodplains with a water table within five feet of grade that is susceptible to liquefaction. Review and update existing, or create new, community plans and ordinances to support hazard mitigation, p. 102,

In this example, the plan received a full score for clarity in this component. This was because the addressed tools were specific, clearly described without generating any ambiguity. The language used was simple, easy to comprehend, and free from jargon. The description provided was adequate and established complete information as relevant to the plan. Hence, it received a full two points for clarity.

A third case is assessed to illustrate a similar case of good clarity score. The example is taken from Johnson County, Iowa.

Figure 27

Good Clarity Score 3 (Mitigation Specific)

Mitigation Plan Components	Inclusio	List of Tools/Choices	Compr	Intern. Compa	Clarity	Comments
Structural tools	1/1	Maximization of tools given primary hazards faced. No tools given primary hazards faced=0, 1 or more, but not all= 1, all given hazards= 2. List of choices: levees, seawalls, riprap or bulkheads, detention ponds, channel maintenance, slope stabilization, storm water management, sewage/drainage management, maintenance of structures, others	1/2	2/2	2/2	Construct West Side Levee, elevate the Normandy/Manor street intersection, secure access to the Peninsula neighborhood, and the Gateway Project cooperation within watershed, Improve, and/or expand storm water systems, as needed, to prevent damage to critical facilities, infrastructure, and property, Storm Water Pump Stations Project reconstruction of bridges (1st Avenue bridge over Clear Creek) Reconstruction of 1st Avenue property demolition

In this example, as well, the plan received a full point for clarity for this component. Even though a few tools/actions were taken into consideration, the plan specified each action clearly and precisely. Information about the mechanism, implementation, and the location was provided adequately. The information was in simple language, easy to comprehend, and free from jargon. Hence, it qualified for full 2 points.

Plans also received a score of 1 for clarity. Some examples are assessed to demonstrate such cases. The first example of such case is taken from Hennepin County, Minnesota.

Figure 28

Bad Clarity Score 1 (Mitigation Specific)

Mitigation Plan Components	Inclusio	List of Tools/Choices	Compr	Intern. Compa	Clarity	Comments
Regulatory tools for hazard zone	1/1	Maximization of tools given primary hazards faced. No tools given primary hazards faced=0, 1 or more, but not all= 1, all given hazards= 2. List of choices: Permitted land use, low density conservation, overlay zone with reduced density provisions, open space dedications, policy to locate public facilities to non-hazardous area, development rights transferred, cluster developments, setbacks, site plan review, special study/impact assessment of development, building standards/codes, land and property acquisition, impact fees, special assessments, retrofitting of private structure, relocation of structures out of hazard zones, drainage ordinance, zoning, Nonconforming use regulations, Subdivision ordinance, differential taxation, Limiting services to areas, Floodplain regulation including management, development ordinance and down zoning, Others	1/2	2/2	1/2	Land permits D3, obtaining easements for planned and regulated public use of privately-owned land for temporary water retention and drainage, Parks, playground, for extreme rainfall, Establishing setbacks: D3 p167, also while building road near slopes, Flood, extreme rain hazard also, D3 Ensuring soil around the structures is less susceptible to frost, Tornado, derechos, garage door, roof and structural frames for winds D3, p. 154, again, Landslides, sink hole, flood, zoning ordinances, Burning restrictions Extreme rain, Adopted ordinances to meet NFIP Flood regulation and management caused by deep frost penetration, land use plans, avoid overpopulation or injection of at-risk groups like children or the elderly in pre-identified high-risk hazardous locations.

In this example, the plan component received a score of 1 for the clarity. Even though the county considered several tools/actions under regulatory tools, no full information about the actions could be derived. The description was not adequate, and the distinction between action items was not made properly. This resulted in ambiguity. As a result, the plan component received a score of 1.

Another case of low clarity score is assessed to demonstrate case is taken from Anoka County, Minnesota.

Figure 29

Bad Clarity Score 2 (Mitigation Specific)

Mitigation Plan Components	**Inclusio**	List of Tools/Choices	**Compr**	**Intern.**	**Clarity Compa**	Comments
Natural resource protection	1/1	Maximization of tools given primary hazards faced. No tools given primary hazards faced=0, 1 or more, but not all= 1, all given hazards= 2. List of choices: general description of best management practice, forest and vegetation management of riparian areas, sediment and erosion control, stream dumping regulations, urban forestry and landscapes, soil conservation and steep slope preservation, dune preservation, wetland protection and preservation, other	1/2	2/2	1/2	Forest and Vegetation part- Mentioned about it time and again but were not clear erosion controls wetland regulation

In this example, the component received one score for clarity. The plan took account of a few strategies/tools offered relevant to the county. However, adequate information about those

actions and their implementation was missing. The actions/strategies lacked elaboration and were incomplete. Therefore, the component received 1 point for clarity.

A third example of a similar case is also assessed. This example was taken from Washington County, Minnesota.

Figure 30

Bad Clarity Score 3 (Mitigation Specific)

Mitigation Plan Components	Inclusio	List of Tools/Choices	Compr	Intern. Compa	Clarity	Comments
Natural resource protection	1/1	Maximization of tools given primary hazards faced. No tools given primary hazards faced=0, 1 or more, but not all= 1, all given hazards= 2. List of choices: general description of best management practice, forest and vegetation management of riparian areas, sediment and erosion control, stream dumping regulations, urban forestry and landscapes, soil conservation and steep slope preservation, dune preservation, wetland protection and preservation, other	1/2	2/2	1/2	Shoreline erosion and shoreline protection identify places for additional small dams and wetland restoration in watersheds K. by using the Natural Resources Inventory as a guide,

In this example, the plan component received a score of 1 for clarity. Here, the plan took account of a few actions in terms of natural resource protection relevant for their county. However, they failed to articulate specific projects and their implementation mechanism. Also,

some of the given descriptions were vague and caused ambiguity in understanding. Therefore, it received a score of 1.

Apart from this, plans also received 0 points for clarity. However, this was only in cases where the inclusion score was 0 in the first place. This is illustrated in Figure 31, which is taken from Outagamie County, Wisconsin.

Figure 31

Bad Clarity Score 4 (Mitigation Specific)

Mitigation Plan Components	**Inclusio**	List of Tools/Choices	**Compr**	**Intern. Compa**	**Clarity**	Comments
Natural resource protection	0/1	Maximization of tools given primary hazards faced. No tools given primary hazards faced=0, 1 or more, but not all= 1, all given hazards= 2. List of choices: general description of best management practice, forest and vegetation management of riparian areas, sediment and erosion control, stream dumping regulations, urban forestry and landscapes, soil conservation and steep slope preservation, dune preservation, wetland protection and preservation, other	0/2	0/2	0/2	Not included at all

In this example, the component was not included in the plan at all. As a result, it lost the inclusion point, followed by comprehensiveness, internal compatibility, and clarity.

The Final detailed Score Distribution Chart in Appendix B shows the distribution of clarity scores throughout each mitigation specific components. It shows that for most of the components that were included in the plans, they earned moderate to full score for clarity.

Likewise, county-wise clarity scores were also noted, showing the total clarity scores earned by plans across mitigation specific components. Table 15 below shows the summary of total clarity scores of mitigation specific components earned by all 30 counties.

Table 15

Clarity Score Summary of All Counties for Mitigation Specific Components

County	State	Clarity Score (out of 16)
Black Hawk	IA	16
DuPage	IL	16
Dekalb	IL	16
Olmsted	MN	16
Milwaukee	WI	16
Cook	IL	15
Anoka	MN	15
Scott	MN	15
La Crosse	WI	15
Johnson	IA	14
Kankakee	IL	14
Dakota	MN	14
Ramsey	MN	14
St. Louis	MN	14
Washington	MN	14
Dane	WI	14
Fond du Lac	WI	14
Outagamie	WI	14
Sheboygan	WI	14
Kendall	IL	13
Hennepin	MN	13
Linn	IA	12
Woodbury	IA	12
Champaign	IL	12
Macon	IL	12
Carver	MN	12
Cass	ND	12
Marathon	WI	12
Winnebago	IL	11
Sangamon	IL	11

The clarity score ranged from 11 to 16 out of a total of 16 points. 5 counties received a full score for clarity while 2 counties received the least.

State-wise Average

After the component-wise score analysis, score comparison analysis was also done across States. This was done for both base components and mitigation specific components. In this analysis, each quality characteristic's average score was calculated for the counties belonging to the same State. Then score comparison was done among states for that particular quality characteristics. This analysis was done for all 4 quality characteristics; inclusion, comprehensiveness, internal compatibility, and clarity across both types of components (Base plan and Mitigation Specific).

Base plan component score

Inclusion

For this evaluation, first, the counties' inclusion scores were categorized according to their respective states. Then, the average score for each State was calculated.

Table 16

Inclusion Score Averaged in Terms of States (Base Plan)

S. N	State	Counties	Inclusion Score (out of 13)	Average Score
1.	North Dakota	Cass	11	11
2.	Minnesota	Scott	11	10
		St. Louis	11	
		Washington	11	
		Ramsey	10	
		Olmsted	10	
		Dakota	10	
		Hennepin	10	
		Carver	9	
		Anoka	8	
3.	Illinois	Champaign	12	10.66
		Cook	12	
		Kankakee	11	
		Kendall	11	
		Winnebago	11	
		Dekalb	10	
		DuPage	10	
		Sangamon	10	
		Macon	9	
4.	Wisconsin	Milwaukee	11	9.43
		Fond du Lac	10	
		La Crosse	10	
		Marathon	10	
		Outagamie	9	
		Sheboygan	9	
		Dane	7	
5.	Iowa	Woodbury	11	10.25
		Black Hawk	10	
		Johnson	10	
		Linn	10	

The average scores in terms of the respective States were calculated. The average Inclusion scores of North Dakota, Minnesota, Illinois, Wisconsin, and Iowa were 11, 10, 10.66, 9.43, and 10.25, respectively. Hence, the average inclusion score was highest in North Dakota and lowest in Wisconsin.

Comprehensiveness

For this evaluation, first, the comprehensiveness scores for the counties were categorized according to their respective States. Then, the average score for each State was calculated.

Table 17

Comprehensiveness Score Averaged in Terms of States (Base Plan)

S. N	State	Counties	Comprehensiveness Score (out of 76)	Average Score
1.	North Dakota	Cass	53	53
2.	Minnesota	Dakota	43	34.33
		Washington	39	
		Hennepin	37	
		Scott	35	
		Ramsey	34	
		Carver	32	
		Olmsted	32	
		St. Louis	30	
		Anoka	27	
3.	Illinois	Cook	51	
		Sangamon	41	36.78
		Champaign	39	
		Winnebago	35	
		Dekalb	34	
		DuPage	34	
		Kankakee	33	
		Kendall	32	
		Macon	32	
4.	Wisconsin	Milwaukee	43	28.14
		Sheboygan	33	
		Fond du Lac	29	
		Marathon	29	
		Outagamie	26	
		La Crosse	25	
		Dane	12	
5.	Iowa	Woodbury	41	33.5
		Black Hawk	38	
		Linn	28	
		Johnson	27	

The average scores in terms of the respective States were calculated. The average comprehensiveness scores of North Dakota, Minnesota, Illinois, Wisconsin, and Iowa were 53, 34.33, 36.78, 28.14, and 33.5, respectively. Hence, the average comprehensiveness score was highest in North Dakota and lowest in Wisconsin.

Internal compatibility

For this evaluation, first, the counties' internal compatibility scores were categorized according to their respective States. Then the average score for each State was calculated.

Table 18

Internal Compatibility Score Averaged in Terms of States (Base Plan)

S. N	State	Counties	Internal Compatibility Score (out of 26)	Average Score
1.	North Dakota	Cass	22	22
2.	Minnesota	St. Louis	22	19.56
		Washington	22	
		Scott	21	
		Olmsted	20	
		Ramsey	20	
		Hennepin	19	
		Carver	18	
		Dakota	18	
		Anoka	16	
3.	Illinois	Cook	23	20.78
		Kankakee	22	
		Winnebago	22	
		Champaign	21	
		Kendall	21	
		Sangamon	20	
		Dekalb	20	
		DuPage	20	
		Macon	18	
4.	Wisconsin	Milwaukee	22	18.29
		Fond du Lac	20	
		La Crosse	20	
		Outagamie	18	
		Marathon	18	
		Sheboygan	18	
		Dane	12	
5.	Iowa	Woodbury	22	20
		Black Hawk	20	
		Johnson	20	
		Linn	18	

The average scores in terms of the respective States were calculated. The average internal compatibility scores of North Dakota, Minnesota, Illinois, Wisconsin, and Iowa were 22, 19.56, 20.78, 18.29, and 20, respectively. Hence, the average internal compatibility score was highest in North Dakota and lowest in Wisconsin.

Clarity

For this evaluation, first, the counties' clarity scores were categorized according to their respective States. Then the average score for each State was calculated.

Table 19

Clarity Score Averaged in Terms of States (Base Plan)

S. N	State	Counties	Clarity Score (out of 26)	Average Score
1.	North Dakota	Cass	22	22
2.	Minnesota	Olmsted	20	17.67
		Ramsey	20	
		Scott	20	
		St. Louis	19	
		Washington	19	
		Dakota	17	
		Hennepin	16	
		Anoka	14	
		Carver	14	
3.	Illinois	Cook	24	19.56
		Kendall	21	
		Champaign	20	
		Winnebago	20	
		DuPage	19	
		Kankakee	19	
		Sangamon	19	
		Dekalb	18	
		Macon	16	
4.	Wisconsin	Milwaukee	21	16.57
		Fond du Lac	19	
		Marathon	17	
		Outagamie	17	
		Sheboygan	17	
		La Crosse	15	
		Dane	10	
5.	Iowa	Woodbury	20	18
		Black Hawk	19	
		Johnson	18	
		Linn	15	

The average scores in terms of the respective States were calculated. The average clarity scores of North Dakota, Minnesota, Illinois, Wisconsin, and Iowa were 22, 17.67, 19.56, 16.57, and 18, respectively. Hence, the average clarity score was highest in North Dakota and lowest in Wisconsin.

Mitigation specific components

Inclusion

For this evaluation, first, the counties' inclusion scores for mitigation specific components were categorized according to their respective states. Then, the average score for each State was calculated.

Table 20

Inclusion Score Averaged in Terms of States (Mitigation Specific)

S. N	State	Counties	Inclusion Score (out of 8)	Average Score
1.	North Dakota	Cass	6	6
2.	Minnesota	Hennepin	8	7.67
		Anoka	8	
		St. Louis	8	
		Washington	8	
		Olmsted	8	
		Scott	8	
		Dakota	7	
		Ramsey	7	
		Carver	7	
3.	Illinois	DuPage	8	7
		Cook	8	
		Dekalb	8	
		Kendall	7	
		Winnebago	7	
		Kankakee	7	
		Sangamon	6	
		Macon	6	
		Champaign	6	
4.	Wisconsin	La Crosse	8	7.14
		Milwaukee	8	
		Dane	7	
		Fond du Lac	7	
		Outagamie	7	
		Sheboygan	7	
		Marathon	6	
5.	Iowa	Black Hawk	8	6.75
		Johnson	7	
		Linn	6	
		Woodbury	6	

The average scores in terms of the respective States were calculated. The average inclusion scores of North Dakota, Minnesota, Illinois, Wisconsin, and Iowa were 6, 7.67, 7, 7.14,

and 6.75, respectively. Hence, the average inclusion score was highest in Minnesota and lowest in North Dakota.

Comprehensiveness

For this evaluation, first, counties' Comprehensiveness scores for Mitigation Specific components were categorized according to their respective states. Then, the average score for each State was calculated.

Table 21

Comprehensiveness Score Averaged in Terms of States (Mitigation Specific)

S. N	State	Counties	Comprehensiveness Score (out of 16)	Average Score
1.	North Dakota	Cass	7	7
2.	Minnesota	Hennepin	10	8.33
		Anoka	9	
		St. Louis	9	
		Olmsted	9	
		Scott	9	
		Washington	8	
		Dakota	7	
		Ramsey	7	
		Carver	7	
3.	Illinois	DuPage	9	7.78
		Cook	9	
		Dekalb	9	
		Kankakee	8	
		Winnebago	8	
		Kendall	8	
		Champaign	7	
		Sangamon	6	
		Macon	6	
4.	Wisconsin	La Crosse	9	8.14
		Milwaukee	9	
		Sheboygan	8	
		Dane	7	
		Fond Du Lac	7	
		Outagamie	7	
		Marathon	7	
5.	Iowa	Black Hawk	9	7.25
		Woodbury	7	
		Johnson	7	
		Linn	6	

The average scores in terms of the respective States were calculated. The average comprehensiveness scores of North Dakota, Minnesota, Illinois, Wisconsin, and Iowa were 7, 8.33, 7.78, 8.14, and 7.25, respectively. Hence, the average comprehensiveness score was highest in Minnesota and lowest in North Dakota.

Internal compatibility

For this evaluation, first, the counties' internal compatibility scores for Mitigation Specific components were categorized according to their respective states. Then the average score for each State was calculated.

Table 22

Internal Compatibility Score Averaged in Terms of States (Mitigation Specific)

S. N	State	Counties	Internal Compatibility Score (out of 16)	Average Score
1.	North Dakota	Cass	12	12
2.	Minnesota	St. Louis	16	15.11
		Washington	16	
		Olmsted	16	
		Scott	16	
		Anoka	16	
		Hennepin	15	
		Dakota	14	
		Ramsey	14	
		Carver	13	
3.	Illinois	DuPage	16	13.78
		Cook	16	
		Dekalb	16	
		Kankakee	14	
		Winnebago	14	
		Macon	12	
		Champaign	12	
		Kendall	12	
		Sangamon	12	
4.	Wisconsin	La Crosse	16	14.28
		Milwaukee	16	
		Dane	14	
		Fond Du Lac	14	
		Outagamie	14	
		Sheboygan	14	
		Marathon	12	
5.	Iowa	Black Hawk	16	13.5
		Johnson	14	
		Linn	12	
		Woodbury	12	

The average scores in terms of the respective States were calculated. The average internal compatibility scores of North Dakota, Minnesota, Illinois, Wisconsin, and Iowa were 12, 15.11, 13.78, 14.28, and 13.5, respectively. Hence, the average internal compatibility score was highest in Minnesota and lowest in North Dakota.

Clarity

For this evaluation, first, the clarity scores of the counties for mitigation specific components were categorized according to their respective states. Then, the average score for each State was calculated.

Table 23

Clarity Score Averaged in Terms of States (Mitigation Specific)

S. N	State	Counties	Clarity Score (out of 16)	Average Score
1.	North Dakota	Cass	12	12
2.	Minnesota	Olmsted	16	14.11
		Anoka	15	
		Scott	15	
		Ramsey	14	
		St. Louis	14	
		Washington	14	
		Dakota	14	
		Hennepin	13	
		Carver	12	
3.	Illinois	DuPage	16	13.33
		Dekalb	16	
		Cook	15	
		Kankakee	14	
		Kendall	13	
		Champaign	12	
		Macon	12	
		Sangamon	11	
		Winnebago	11	
4.	Wisconsin	Milwaukee	16	14.14
		La Crosse	15	
		Outagamie	14	
		Dane	14	
		Fond Du Lac	14	
		Sheboygan	14	
		Marathon	12	
5.	Iowa	Black Hawk	16	13.5
		Johnson	14	
		Linn	12	
		Woodbury	12	

The average scores in terms of the respective States were calculated. The average clarity scores of North Dakota, Minnesota, Illinois, Wisconsin, and Iowa were 12, 14.11, 13.33, 14.14, and 13.5, respectively. Hence, the average clarity score was highest in Wisconsin and lowest in North Dakota.

Conclusion

This chapter provided with the detailed result of the plan evaluation. Several findings were elaborated corresponding to the quality characteristics of both base plan components and mitigation specific components of all 30 plans. Also, plan performance in terms of States was evaluated. The next chapter discusses about the obtained results and their subsequent implications to mitigation planning.

CHAPTER 5. DISCUSSION AND CONCLUSION

Hazard mitigation plans are important documents to guide a community towards a disaster resilient environment. A body of literature exists that identifies the necessity and importance of these plans and how they manifest appropriate mitigation strategies. This body of research has also identified several vital components and characteristics for formulating robust, high-quality plans. This identification of components and characteristics has been disseminated to practitioners because the quality of the mitigation plans was found to be moderate to good.

Disasters are majorly localized events, and hence it is important to empower a community on a local level to mitigate their impacts. Local-level planning is important for several events and aspects, including disasters. Quality plans at the local level are the key to quality mitigation approaches and strategic actions. This research evaluated hazard mitigation plans of 30 large jurisdictions mid-west counties and derived their plan quality. This chapter analyses their findings and discusses their implications.

Quality Characteristics

The evaluation of the plan components, both base, and mitigation specific, revealed plans were oriented towards higher quality. Except for comprehensiveness, the other qualities like inclusion, internal compatibility and clarity were fairly good. The status of 4 quality characteristics is discussed below.

Inclusion

Base plan components

No plan included all the 13 base plan components. However, the highest inclusion recorded was 12 which was near perfect, in terms of inclusion. While missing components varied

from plan to plan, it was found that 3 of them were significantly missing compared to the rest of the 10 components. The majorly missing components were vision, objectives, and plan testing.

Vision refers to visualizing, more like foreseeing a discernible future after the execution of the plan. Based on this visualization, plans are supposed to build their way by formulating relevant goals and objectives. However, the county plans largely failed to visualize the desired result, breaking the linkage between vision, subsequent goals, and relevant objectives. Since vision and goals are linked, without vision it is not easy to set appropriate goals. Moreover, without appropriate goals, the direction of the plans can alter deviating from its real motive: the community's overall safety and reduction of hazard impacts.

Objectives are the broken-down version of goals. They bring the goals to life through a series of specific, doable, and measurable actions. The county plans did set the goals but comparatively failed to set the objectives to meet those goals. Without objectives, it is hard to initiate any actions for the execution of plans. This may result in flawed execution leading to an undesired result. Only carefully set objectives concerning the goals serve as connecting dots to draw the plan's whole picture.

Plan testing is the process of measuring the effectiveness and progress of the plan. This is an important component because it helps determine if specific actions, strategies are beneficial, and if those courses of action and strategies should be altered, discarded, or continued further. It helps to identify the gaps in the mitigation efforts. Since these county-plans severely lack this component, counties cannot determine if their designed plans are actually helping them or just putting the effort in vain. This could lead to a great loss of time, effort, and resources if the designed plans and action courses happened to be inappropriate.

Mitigation specific components

Unlike base plan components, in mitigation specific, 4 of the components were present in all 30 plans. They were regulatory tools for hazard zone, structural tools, public facilities and infrastructure, and awareness/educational tools. Majority of the plans did include general policy and incentive-based tools. However, the components significantly missing, in this case, were modeling technique and tools and natural resource protection.

9 plans did not address or include the modeling technique and tools such as hazard mapping, risk profiling, and modeling in their mitigation strategies. Theoretically, modeling techniques do not constitute as a mitigation technique. However, they help in portraying different hazard zones requiring different management practices (Begueria, 2006). They illustrate the geographic distribution of risk that can be leveraged to both public and professionals (Severtson & Burt, 2012). This helps to understand the vulnerability and the extent of impacts for that particular location, which are essential in appropriating the necessary actions and make adequate plans days/months ahead of disasters. Hence, it is essential to consider modeling techniques for the achievement of better hazard mitigation.

Similarly, 13 plans failed to include natural resource protection component in their mitigation plans. Natural resources like vegetation, wetlands have great mitigating characteristics. Wetlands absorb and block the storm surges and lessening their intensity. Also, they help in storing and slow release of water downstream, aiding in groundwater recharge while decreasing both flood and drought risk (Endter-Wada et al., 2018; Endter-Wada et al., 2020). Similarly, vegetations increase soil stabilization reducing flood and storm impacts (Espeland and Kettenring, 2018; Tanaka, 2009). Techniques like soil conservation and slope preservation also help in erosion control, debris formation, and landslides (Joshi et al., 1998). Since the selected

plans were of large population jurisdiction, mostly dominated by urban settings, this very technique may be less helpful. Also, since most of the planning committee consisted of practitioners and county jurisdictions officials who may not necessarily have adequate scientific knowledge behind the mitigation benefits of the natural resources. This could also be attributed to the failure in including these techniques.

Comprehensiveness

Base plan components

Even though plans included most of the base plan components, they failed in addressing all the sub-elements for those components. Their relatively low comprehensiveness scores confirmed this. While some of the losses were attributed to missing the main component, other losses were arbitrary and varied across the plans (Refer to Final Detailed Score Chart in Appendix B).

For instance, vision was included in 4 plans. However, only 2 of them were along the line of viewing themselves due to implementing the plan, meeting the comprehensiveness criteria. Likewise, only 4 plans had their goals directed towards vision, as it can be seen that only 4 had the vision statement. Furthermore, very few addressed sustainability and resilience aspect in their goals. In the case of objectives, no plan included the time-bound of their identified objective.

On the other hand, scope was the component included in all plans somehow, but failing significantly in comprehensiveness. Except for the description of administrative limitations, the other scope elements were identified few to bare times. Similar was the case with the planning process. Apart from describing the groups and individuals involved, frequency of contact, and various techniques for getting information from the stakeholders, other elements were addressed in very few plans. Almost all the plans included the legal foundation component. However,

elementwise each of the elements was found in a moderate number of plans. The hazard analysis part was well-formulated in most of the plans.

The only part missing significantly was the assumptions/limitations associated with identifying the hazards. The same was the case with the vulnerability assessment. However, unlike hazard analysis, the other components in vulnerability assessment were addressed moderate to low times. Plans somehow did better in risk assessment compared to vulnerability assessment. However, very few plans pointed out the assumptions associated with identifying risk and described indirect impacts. Plans majorly talked about the direct impacts but barely took account of the indirect ones. Also, almost all the plans failed to describe the relationship between hazard, vulnerability, and risk. Plans did reason why hazard analysis was critical, why vulnerability assessment was essential or why risk assessment was important. However, these reasons were provided individually or a few times relating to the two assessments. However, except for 1, none of the plans established the relationship between all 3 assessments and why that was important.

Plan Testing, on the other hand, barely qualified for inclusion, hence contributing to a particular portion of missing scores for Comprehensiveness. In the case of plan maintenance, plans majorly talked about the time frame for plan revision and maintenance but somehow missed the timeframe for review. In some cases, the timeframe for review and revision was the same. For plan implementation, most of the plans addressed responsibility for implementation and identified the financial recourse required but missed to address the other elements for that component. The comprehensiveness score for definition was good as all the plans that included definitions component did include the definitions of key terms and phrases.

Overall, all plans included the chunks and pieces of information pertaining to each of the plan components' elements. However, they did not succeed in providing everything. Each plan element has its own value in forming a complete picture of the plan. Their information are the indicators of the plan direction, something that denotes the extent and types of mitigation strategies that should be taken, adding the high value to the plan. However, the comprehensiveness scores showed that counties still lack the concept of many of these components and how they enhance the plan's quality.

Mitigation specific components

The inclusion of mitigation specific components in plans was laudable. As discussed, except for the 2 components, modeling technique and tools, and natural resource protection, the rest were included in almost all plans. Even these two were included in more than half of the plans. However, having a better Inclusion did not correspond to having a better comprehensiveness. Their comprehensiveness score confirmed this (Refer to Final Detailed Score Chart in Appendix B).

17 plans received a full score for comprehensiveness in general policy, and 2 plans received the same for public facilities and infrastructure. Apart from these, majority of the plans that had included the specific component only received a half score for comprehensiveness. This low comprehensiveness score was attributed to the failure of plans in maximizing the possible tools applicable to the primary hazards they faced. They did include some tools for each component but not all, hence, not optimizing their maximum potential or reach in applying those tools. Therefore, as in the case of base plan components, the comprehensiveness in mitigation specific components was low. Plans considered few to some tools for all components, where they could have taken account of all that could ensure maximum mitigation they could truly achieve.

Internal compatibility

Base plan components

Plans performed better in internal compatibility among all the quality characteristics. For all the included components, majority of the plans received a full point in it (Refer to Final Detailed Score Chart in Appendix B). Even though plans failed to include some components and did not address all the sub-components, their included content for the respective components was relevant and coherent. Except for a few cases, the information provided did not contradict and were at least consistent throughout.

Plans need to be internally compatible to make it consistent with its motive or goals. Lack of this feature hinders the meaning of the plan and its direction. Still, some plans or some components fell short in this feature. However, these plans need to work on the improvement of this characteristic to enhance their plan quality.

Mitigation specific components

For mitigation specific components, the plans performed better in internal compatibility. Despite their failure to maximize the available tools, the plans were comparatively able to establish the relevance of actions/strategies they had chosen to target the hazards they faced. Except for some cases, their chosen tools were consistent with their goals and need of the county.

The chosen actions and tools need to be appropriate for the county. That choice is determined by factors like the hazard faced, geographical features, administrative unit, and capability of the county. Even though much of the plan did well, few of them could not build that part well. The internal compatibility of the mitigation specific components is equally built up by the information from the base plan components. Components like plan goals, objectives, hazard analysis, risk assessment, vulnerability assessment, and plan implementation help narrow down

the tools/actions chosen in this section. The chosen tools need to correspond with the information provided by those parts. Then only the counties can leverage the maximum benefit of their chosen tools.

Clarity

Base plan components

Plans did moderate to well in clarity for Base Plan Components. There were two main issues for reduced clarity. First, it was because of plans not addressing maximum sub-components, missing out on pieces needed for the main component's complete picture. As discussed previously, this reduced their comprehensiveness score, followed by the clarity score. Second, even if certain sub-components were addressed, they were not adequately described or elaborated well.

Otherwise, the plans that did score well for clarity had maximum to all sub-components addressed along with a fair and precise description of all, enabling to formulate a better picture of the specific component. Plans barely had the issue of jargon or overuse of technical terms. Plans need to be thorough and easy to understand as these plans are assessed by stakeholders, county jurisdictions, and the public belonging to different domains and professions. Furthermore, it is essential for the plans to be into everyone's understanding to input the feedback, make necessary amendments and help in its consistent evolution. Also, graphical and visual representation, along with reliable evidence, build the plan's strength and reliability.

Mitigation specific components

Like base plans components, mitigation specific component (of the plans) also did moderate to well in clarity. In case of reduced clarity score, it was mostly due to lack of adequate description of the specific projects or the tools or implementation mechanism, as discussed in the

Results section. It is important for the plans to clarify the chosen tools and elaborate better so that the stakeholders and the public can subsequently visualize those actions and how they are implemented precisely. Simple language, sufficient description, clarification of technical terms, selected policies, protocols; these all build the clarity of the Mitigation specific Components and are important for better plan quality.

State-wise Average

Base plan components

In base plan components, the State-wise average for each quality characteristic revealed similar results. In the case of inclusion, North Dakota had the highest average. Illinois followed this at second, Iowa at third, Minnesota at fourth, and lastly, Wisconsin at fifth. For comprehensiveness, there was a slight change. North Dakota had the highest average for comprehensiveness. This was followed by Illinois at second, unlike Inclusion Minnesota at third, Iowa at fourth, and Wisconsin at fifth. The other two characteristics, internal compatibility, and clarity followed the same trend as inclusion. Hence, North Dakota and Illinois performed better in the base plan than the rest of the States. For North Dakota, this could be attributed to the stakeholders' conceptual clarity from a relevant degree and research program in Emergency Management. The stakeholder group for Cass County in Fargo also included individuals having/pursuing a degree in Emergency Management, one of the top programs offered by North Dakota State University. Hence, the application of academia into practice did bring about better results. For Illinois, there was overall higher inclusion and higher comprehensiveness that subsequently uplifted its overall average. For other states, missing some major components and reduced comprehensiveness score played a role in lowering their overall rank.

Mitigation specific components

The result of the State-wise average was a contrast in mitigation specific components, compared to base plan components. In the case of inclusion, Minnesota had the highest average. Wisconsin followed this at second, Illinois at third, Iowa at fourth, and North Dakota at fifth. This trend was the same for comprehensiveness and internal compatibility. There was a slight change for clarity. In this case, Wisconsin had the highest average. This was followed by Minnesota at second, Iowa at third, Illinois at fourth, and North Dakota at fifth.

Minnesota and Wisconsin did better in mitigation specific components. These states had better inclusion of the Components in overall compared to other States. Hennepin County of Minnesota had the highest comprehensiveness score. These helped in uplifting the overall average of Minnesota and Wisconsin. In case of other States, the lack of inclusion of certain components can be attributed to the reduced average score. Unlike in the base plan component, North Dakota did not include all the components of mitigation. This significantly reduced its subsequent scores resulting in a lower average.

However, these results are not very generalizable. The number of counties from each States differed significantly. From a single county in North Dakota to 9 counties each in Minnesota and Illinois, the range of County number was vast, reducing the reliability of this result for State-wise average. Nevertheless, it can still be taken as a reference for future analysis.

Miscellaneous Observations and Analysis

Apart from these significant observations and analysis, some other anomalous findings were also noted. First, many plans were excessively long with redundant and extraneous information that did not contribute to the plan quality. One such example was the Hennepin County plan. The plan was formulated into 3 large documents providing much information from

here and there. However, the plan failed to include vulnerability assessment, dragging the plan's score down. Plans were also found to be adding recovery related task, which, was not necessary in mitigation plan.

Two plans, Cook County, Illinois, and Hennepin County, Minnesota, also addressed climate risks and climate change impacts that could result in increased impacts of potential hazards in both quantity and intensity. These plans advocated for the formulation of climate adaptation strategies that should include mitigation methods accounting for the needs of the entire, specifically the most vulnerable population groups. It has become important to address climate risks and their adaptation strategies in the hazard mitigation plans and sensitizing the jurisdiction about its severity and ways to cope with them.

Apart from that, the strong aspect or the component throughout all plans was hazard analysis. Plans sometimes missed a point or two for missing variable plan elements. Nonetheless, most plans identified the major hazards, had an adequate description of those hazards, their potential impacts, and provided as much information as possible on each. Since all counties lie in the same geographical region, they faced similar hazards. The major hazards affecting all these counties were flood, storm events (hurricane, tornado), and severe weather events, including excessive cold, blizzard, drought, and heatwaves. Hence their mitigation strategies and choice of tools were also similar to the most extent.

Implications

After the completion of the analysis of these 30 plans, it can be deduced that the status of mitigation plans is moderate to good in overall. This research contradicts with previous research findings (Berke & Godschalk, 2009; Kang et al., 2010; Lyles et al., 2012; Lyles et al., 2013) that the quality of local mitigation plans is moderate to low. The contradiction in findings between

this research and previous research could be attributed to the choice of counties. These previous researches evaluated coastal counties while this study focused on large jurisdiction counties, meaning those having population greater than or equal to 100,000 and largely dominated by urban setting. Therefore, the higher scores in this research confirms the findings of other plan quality research that indicate higher scores and hence better quality for urban counties compared to rural (Berke et al., 2009; Frazier et al., 2013; Horney et al., 2012; Horney et al., 2017). The greater access to resources in these larger jurisdictions and higher capacity of urban government agencies contribute to higher scores in these counties. Hence, the relatively positive scores obtained in this study conform to the expectations that we have from the larger counties. In contrast, rural counties often lack internal expertise, resources and, motivation to prepare and evaluate the mitigation plans. They depend mostly on consultants for the preparation (Berke et al., 2009; Frazier et al., 2013). This leads to a significant compromise in their data quality and in-depth analysis, as a result of which their quality scores get reduced.

Even though the plans in this study performed fairly good, there are still some areas that needs improvement. The shortcomings and major issues associated with each quality characteristics were pointed and discussed in previous sections. Based on them, some implications can be drawn from this research, which shall help identify some potential barriers.

Conceptual lacking

The overall analysis and the scores of these plans denote some conceptual flaws among the planners. Lack of conceptualization of plan components and an adequate understanding of their corresponding plan elements are still evident in the plans. For instance, the concept of a visionary plan is absent. Even the very few plans that have created a vision do not comply with the comprehensiveness criteria. Also, planners do not know the clear distinction between risk

assessment and vulnerability assessment. While clear headings were provided for both, information regarding vulnerability assessment would be found under risk assessment, and vice versa, and, information regarding risk assessment would also be found in hazard assessment. The absence of subsequent clustering of the information was still an issue. Likewise, even if some components were identified, they failed to cover all the key elements.

This lacking could be attributed to emergency management practice, not building upon adequate knowledge and concepts in the first place. Second, the practice being uninformed by research and academia. Academia and research should communicate more with planners and stakeholders to help tackle conceptual barriers. The absence of communication between research and practice resulted in missing of full plan compliance with what we know. This lack of distinction in concepts, in terms, in ideas can cause great confusion when seeking information while also misleading the overall concept.

Context

Context is one of the significant determinants of plan quality (Perry & Lindell, 2007). Knowing the context surrounding all these counties or some specific counties could have further helped in identifying the hindrance for better plans. One of the contextual issues may be a lack of personnel or expertise to facilitate and guide the systematic planning process. Despite the inclusion of diverse stakeholders in the planning committee, the plans missed some steps to perfection. This could be because the emergency managers had other priorities than planning and had not received adequate training and exercise. These kinds of situations in the county could also lead to compromise in forming better and improved plans.

Limitations

While this research was conducted with the utmost care and concentration, some limitations still need to be identified. The first limitation is evaluator's subjectivity. Even though it was tried best to go through the content thoroughly and be consistent with judgment, some information could have been missed or over included due to differential thought processes. Evaluating large documents where the presentation of information was scattered and varied was a great challenge in itself. Therefore, some judgment errors can be attributed.

The second significant limitation was the inability to assess external compatibility. External compatibility refers to "the relevance of the scope and coverage to reflect stakeholder values and the local situation to maximize use and influence of the plan" (Berke & Godschalk, 2009; Lyles & Steven, 2014). As mentioned in chapter 2, despite being an essential quality criterion, it is impossible to assess it looking at paper plans.

Lastly, the findings of this study cannot be generalized by the other counties not included in the sample. Since specific criteria was employed to select these group of plans, the findings could overlap with other counties having similar traits. Otherwise, if the county is of smaller jurisdiction or lies in an entirely different geographical area, the findings may not be very helpful. To be precise, larger jurisdictions or urban counties can mostly relate to these findings. However, this does not refrain other counties to consult these findings. Counties can analyze the information and use them per their own convenience and context.

Recommendation

Based on the evaluations and researcher's knowledge in emergency management, a number of recommendations are noted that can assist researchers and planners. These recommendations are provided here on.

Recommendation 1: Communicate with research

Hazard mitigation plans are essential documents in guiding the mitigation actions at any level. Hence, the information presented in the document should be apt, clear, and free from conceptual ambiguity. Apart from various county stakeholders, planners should also consider the participation of individuals with an academic background in emergency management with some research experience. That way, we can ensure theory meeting practice for formulating better plan guidelines.

Recommendation 2: Utilize the evaluation form

The evaluation form used in this research contains all the content areas included in a high-quality mitigation plan. Planners can use this to build the plan documents and enhance the planning process in a systematic way. This form shall also help planners articulate the information needed for hazard, risk, and vulnerability assessment and understand how these three are different yet interwind concept.

Recommendation 3: Make the document concise

It was found that plans were unnecessarily lengthy, with extra information not useful for mitigation plans. While the plans lacked the necessary information pointed out in the evaluation form now and then, extraneous and overly detailed information were present in most plans that diverted the notion of ‘Mitigation plans’. Therefore, plans should include the right amount of information and in the right format so that the content does not deviate the reader’s or evaluator’s attention while also keeping the plan grounded on the right track.

Recommendation 4: Future research

The study showed that these large jurisdictions had comparatively high-quality plans. According to the literature, we had found that higher quality means better implementation. However, their implementation is something that can be assessed in the next step, hence, directing the future research to see if these high-quality plans are really being implemented and to what extent.

Next, the future research can strive to understand the divergence between urban and rural hazard mitigation plans and the reasons for their divergence. The comparative study between these two types of counties can either strengthen our deduction that urban plans are better than rural plans or else help explore other factors that equally play the role. This is up to the future research that helps in evolvement of these concepts.

Conclusion

The findings of this study shall contribute significantly to the body of literature and Emergency Management practice in terms of Mitigation planning. The study looked at the research literature to determine the various components, factors, and characteristics that should be included to produce a high-quality plan. Based on the literature findings, a plan-evaluation worksheet was validated, and 30 individual county's hazard mitigation plans were evaluated for quality.

Sound planning is an integral process for effective hazard mitigation. Plans serve as a guiding document for the community for the implementation of mitigation actions. Overall, the plans performed moderate to well across each characteristic. The evaluation conducted for the plans, however, identified some shortcomings in their plans that could affect their ability to mitigate the hazard impacts strategically.

First, the plans did not include all the components identified as key to the plans. Plans did not follow a uniform format or order. Inclusion issue varied across plan except 3 (Vision, Objectives and Plan testing) significant for base plan component and 2 (Modeling technique and tools and Natural resource protection) for mitigation specific.

Second, the comprehensiveness of the plans was comparatively lower. Despite including certain components, plans did not identify all the sub-elements. This was a recurring process in the plans, contributing in reduced score. For mitigation, plans failed to include all the appropriate tools, lowering the optimization of mitigation endeavor and overall comprehensiveness score.

Third, internal compatibility was better among all the plans except in a few cases. This could be resolved with better practice and evolving ideas on high-quality plans. Lastly, the clarity of the plans was moderate to good. Inadequate information, missing visual graphics, and substantial evidence were some of the recurring issues for clarity reduction.

These findings confirm the previous research that the plan quality was moderate to good in large jurisdictions (Berke et al., 2009; Frazier et al., 2013; Horney et al., 2012; Horney et al., 2017). Plans, however, still need to work on some critical areas as mentioned to further enhance their quality. Mitigation planning should consider expanding stakeholder participation with more expertise in planning, plan elements, and the value they add to the plan quality. Counties can refer to this evaluation form, used for this research to tally their plan quality and make necessary improvements. Counties should also consider testing their plans regularly to identify the gaps, increase the plan knowledge, and turn it into a living document with continuous evolvement. These recommendations are the starting point for improving county mitigation plans. Overall, more research should be done to help counties create more inclusive, comprehensive, internally

compatible, and clear plans. This study opens the door for future research to evaluate county plans and suggest better ways to produce robust and high-quality plans.

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APPENDIX A. PLAN EVALUATION FORM

Component & Sub-Components	Inclusion	Specific Planning Elements Assessed	Compr	Intern Comp	Clarity
Base Components					
Vision	/1	Description of the community's/organization's vision of itself as a result of implementing the plan	/1	/2	/2
Goals	/1	Goals are directed towards the vision Goals address sustainability and /or resilience as appropriate to plan type Goals are future-oriented, positive statements that can be used to frame policies	/3	/2	/2
Objectives	/1	Objectives are directed toward fulfilling goals Objectives are specific Objectives are measurable Objectives are attainable Objectives are realistic Objectives are time-bound	/6	/2	/2
Scope	/1	Plan assumptions identified Description of plan horizon Description of plan development structure role Description of plan development structure responsibilities Description of plan development structure relationships Descriptions of geographic limitations of plan Description of administrative limitations of plan Statement of how this plan fits with other jurisdictional/ organizational AND emergency management plans	/8	/2	/2
Planning process: Who and How involved	/1	Description of groups/individual organizations (should show broad involvement) Description of numbers involved Description of who involved what stages Description of frequency of contact with who involved Description of a variety of techniques used to provide information to stakeholders Description of number of techniques used to provide information to stakeholders Description of variety of techniques used to get information from stakeholders Description of number of techniques used to get information from stakeholders Description of how stakeholders influenced the process	/9	/2	/2
Legal Foundation	/1	Description of authority to plan provided by federal, state, and/or local regulations Description of duty to plan provided by federal, state, and/or local regulations Descriptions of standards referred to in process of plan development	/3	/2	/2
Hazard Analysis	/1	Process used to identify hazards explained Any assumptions/limitations associated with process to identify hazards explained Potential types of hazards listed Description of characteristics of each hazard Mapping and/or modeling of hazards demonstrated Sources of data described (multiple sources referred to)	/6	/2	/2

Vulnerability Analysis	/1	Process used to assess vulnerabilities explained Any assumptions/limitations associated with process to identify vulnerabilities explained Geographic vulnerabilities assessed Assessment of geographic vulnerabilities data informed Assessment of geographic vulnerabilities based on reliable data Social vulnerabilities assessed (i.e., health care system, employment, poverty index, languages spoken in area, educational background, gender, age, rent vs. own) Assessment of social vulnerabilities data informed Assessment of social vulnerabilities based on reliable data Special needs understood and addressed as appropriate to plan type (i.e., communication, medical, maintaining functional independence, supervision, transportation, pets) Economic vulnerabilities assessed (i.e., infrastructure, businesses, critical facilities, industry) Assessment of economic vulnerabilities data informed Assessment of economic vulnerabilities based on reliable data	/12	/2	/2
Risk Assessment	/1	Process used to assess risk explained Any assumptions/limitations associated with process to identify risk explained Direct impact assessed Indirect impact assessed Assessments are data informed Data used is reliable Likelihood established Hazards prioritized/ranked Relationship of hazard, vulnerability and risk processes to planning described	/9	/2	/2
Plan Testing	/1	Schedule of periodic ongoing training Identification of who will be targeted in training Identification of the purpose of training Identification of how feedback will be provided and incorporated from exercises Schedule of periodic ongoing exercise (if applicable) Identification of who will be targeted in exercises Identification of what will be tested in exercises Identification of how feedback will be provided and incorporated from exercises	/8	/2	/2
Plan Maintenance	/1	Specifies time frame on an ongoing basis in which the plan will be reviewed Specifies time frame on an ongoing basis in which the plan will be revised Describes process by which maintenance will be conducted	/3	/2	/2
Plan Implement	/1	Responsibility for implementation identified Identification of human resources acquired Identification of financial resources required Identification of technical resources required Discussion of how resources will be acquired Description of how evaluation will be handled including indicators Inclusion of flexibility statement	/7	/2	/2
Definitions	/1	Definitions for key terms and phrases are provided	/1	/2	/2
TOTALS	/13		/76	/26	/26

Mitigation Specific Components					
General Policy	/1	Discourage hazardous area development Support adoption of new regulatory legislation at local level	/2	/2	/2
Regulatory tools for hazard zone	/1	Maximization of tools given primary hazards faced. No tools given primary hazards faced=0, 1 or more, but not all= 1, all given hazards= 2. List of choices: Permitted land use, low density conservation, overlay zone with reduced density provisions, open space dedications, policy to locate public facilities to non-hazardous area, development rights transferred, cluster developments, setbacks, site plan review, special study/impact assessment of development, building standards/codes, land and property acquisition, impact fees, special assessments, retrofitting of private structure, relocation of structures out of hazard zones, drainage ordinance, zoning, Nonconforming use regulations, Subdivision ordinance, differential taxation, Limiting services to areas, Floodplain regulation including management, development ordinance and down zoning, Others	/2	/2	/2
Modeling techniques and tools	/1	Maximization of tools given primary hazards faced. No tools given primary hazards faced=0, 1 or more, but not all= 1, all given hazards= 2. List of choices: GIS maps, Risk profiles, others	/2	/2	/2
Incentive based tools	/1	Maximization of tools given primary hazards faced. No tools given primary hazards faced=0, 1 or more, but not all= 1, all given hazards= 2. List of choices: Land and property acquisition, retrofitting private structures, tax abatement for mitigation, density bonus, low interest loans, NFIP, others	/2	/2	/2
Structural tools	/1	Maximization of tools given primary hazards faced. No tools given primary hazards faced=0, 1 or more, but not all= 1, all given hazards= 2. List of choices: levees, seawalls, riprap or bulkheads, detention ponds, channel maintenance, slope stabilization, storm water management, sewage/drainage management, maintenance of structures, others	/2	/2	/2
Public facilities and infrastructure	/1	Maximization of tools given primary hazards faced. No tools given primary hazards faced=0, 1 or more, but not all= 1, all given hazards= 2. List of choices: capital improvement plans, retrofitting public structure, retrofitting critical facilities, others	/2	/2	/2
Awareness/educational tools	/1	Maximization of tools given primary hazards faced. No tools given primary hazards faced=0, 1 or more, but not all= 1, all given hazards= 2. List of choices: education/training opportunities for community, staff, private stakeholders and students Maximization of tools given primary hazards faced. No tools given primary hazards faced=0, 1 or more, but not all= 1, all given hazards= 2. List of choices: real estate hazard disclosure, hazard notification, maps of areas subject to hazard, disaster warnings and response programs hazardous signage and related location, technical mitigation assistance, inclusion of floodplain boundaries, workshops, education/training in several languages, hazard information center, others	/2	/2	/2

Natural resource protection	/1	Maximization of tools given primary hazards faced. No tools given primary hazards faced=0, 1 or more, but not all= 1, all given hazards= 2. List of choices: general description of best management practice, forest and vegetation management of riparian areas, sediment and erosion control, stream dumping regulations, urban forestry and landscapes, soil conservation and steep slope preservation, dune preservation, wetland protection and preservation, other	/2	/2	/2
TOTALS TYPE	/8		/16	/16	/16

APPENDIX B. FINAL DETAILED SCORE CHART

Base Plan Component	No. of counties that included the components	Planning Elements Assessed	Number of counties that included each of the elements	Total counties that had Internal Compatibility Score of 2	Total counties that had Internal Compatibility Score of 1	Total counties that had Internal Compatibility Score of 0	Total counties that had the Clarity Score of 2	Total counties that had the Clarity Score of 1	Total counties that had the Clarity Score of 0
Vision	4	Description of the community's/organization's vision of itself as a result of implementing the plan	2	2	0	28	2	1	27
Goals	29	Goals are directed towards the vision	4	26	1	3	23	3	4
		Goals address sustainability and /or resilience as appropriate to plan type	6						
		Goals are future-oriented, positive statements that can be used to frame policies	25						
Objectives	13	Objectives are directed toward fulfilling goals	11	12	1	17	11	2	17
		Objectives are specific	11						
		Objectives are measurable	10						
		Objectives are attainable	13						
		Objectives are realistic	13						
		Objectives are time-bound	0						
Scope	30	Plan assumptions identified	3	30	0	0	17	13	0
		Description of plan horizon	12						
		Description of plan development structure role	5						
		Description of plan development structure responsibilities	3						
		Description of plan development structure relationships	2						
		Descriptions of geographic limitations of plan	11						
		Description of administrative limitations of plan	26						
		Statement of how this plan fits with other jurisdictional/ organizational AND emergency management plans	15						
Planning Process	30	Description of groups/individual organizations (should show broad involvement)	29	30	0	0	23	7	0
		Description of numbers involved	2						
		Description of who involved what stages	6						
		Description of frequency of contact with who involved	27						
		Description of a variety of techniques used to provide information to stakeholders	13						
		Description of number of techniques used to provide information to stakeholders	4						
		Description of variety of techniques used to get information from stakeholders	27						
		Description of number of techniques used to get information from stakeholders	7						
		Description of how stakeholders influenced the process	4						

Legal Foundation	29	Description of authority to plan provided by federal, state, and/or local regulations	17	29	0	1	25	4	1
		Description of duty to plan provided by federal, state, and/or local regulations	15						
		Descriptions of standards referred to in process of plan development	22						
Hazard Analysis	30	Process used to identify hazards explained	26	28	2	0	20	10	0
		Any assumptions/limitations associated with process to identify hazards explained	8						
		Potential types of hazards listed	30						
		Description of characteristics of each hazard	29						
		Mapping and/or modeling of hazards demonstrated	24						
		Sources of data described (multiple sources referred to)	27						
Vulnerability Analysis	28	Process used to assess vulnerabilities explained	15	27	1	2	26	2	2
		Any assumptions/limitations associated with process to identify vulnerabilities explained	6						
		Geographic vulnerabilities assessed	22						
		Assessment of geographic vulnerabilities data informed	11						
		Assessment of geographic vulnerabilities based on reliable data	10						
		Social vulnerabilities assessed (i.e., health care system, employment, poverty index, languages spoken in area, educational background, gender, age, rent vs. own)	19						
		Assessment of social vulnerabilities data informed	7						
		Assessment of social vulnerabilities based on reliable data	6						
		Special needs understood and addressed as appropriate to plan type (i.e., communication, medical, maintaining functional independence, supervision, transportation, pets)	11						
		Economic vulnerabilities assessed (i.e., infrastructure, businesses, critical facilities, industry)	27						
		Assessment of economic vulnerabilities data informed	23						
		Assessment of economic vulnerabilities based on reliable data	20						

Risk Assessment	30	Process used to assess risk explained	22	29	1	0	26	4	0
		Any assumptions/limitations associated with process to identify risk explained	9						
		Direct impact assessed	29						
		Indirect impact assessed	10						
		Assessments are data informed	27						
		Data used is reliable	25						
		Likelihood established	28						
		Hazards prioritized/ranked	25						
		Relationship of hazard, vulnerability and risk processes to planning described	1						
Plan Testing	1	Schedule of periodic ongoing training	0	1	0	29	1	0	29
		Identification of who will be targeted in training	0						
		Identification of the purpose of training	0						
		Identification of how feedback will be provided and incorporated from exercises	0						
		Schedule of periodic ongoing exercise (if applicable)	1						
		Identification of who will be targeted in exercises	1						
		Identification of what will be tested in exercises	1						
		Identification of how feedback will be provided and incorporated from exercises	0						
Plan Maintenance	27	Specifies time frame on an ongoing basis in which the plan will be reviewed	17	27	0	3	24	3	3
		Specifies time frame on an ongoing basis in which the plan will be revised	26						
		Describes process by which maintenance will be conducted	26						
Plan Implement	29	Responsibility for implementation identified	28	27	2	1	23	6	1
		Identification of human resources acquired	13						
		Identification of financial resources required	26						
		Identification of technical resources required	7						
		Discussion of how resources will be acquired	8						
		Description of how evaluation will be handled including indicators	10						
		Inclusion of flexibility statement	2						
Definitions	24	Definitions for key terms and phrases are provided	24	24	0	6	23	1	6

Mitigation Specific Components

Components	No. of counties that included the components	Sub-Components	Total number of counties that received the comprehensive score of 2	Total number of counties that received the comprehensive score of 1	Total number of counties that received the comprehensive score of 0	Total counties that had Internal Compatibility Score of 2	Total counties that had Internal Compatibility Score of 1	Total counties that had Internal Compatibility Score of 0	Total counties that had the Clarity Score of 2	Total counties that had the Clarity Score of 1	Total counties that had the Clarity Score of 0
General Policy	28	Discourage hazardous area development Support adoption of new regulatory legislation at local level	17	11	2	27	1	2	25	3	2
Regulatory tools for hazard zone	30	Maximization of tools given primary hazards faced. No tools given primary hazards faced=0, 1 or more, but not all= 1, all given hazards= 2. List of choices: Permitted land use, low density conservation, overlay zone with reduced density provisions, open space dedications, policy to locate public facilities to non-hazardous area, development rights transferred, cluster developments, setbacks, site plan review, special study/impact assessment of development, building standards/codes, land and property acquisition, impact fees, special assessments, retrofitting of private structure, relocation of structures out of hazard zones, drainage ordinance, zoning, Nonconforming use regulations, Subdivision ordinance, differential taxation, Limiting services to areas, Floodplain regulation including management, development ordinance and down zoning, Others	0	30	0	29	1	0	28	2	0
Modeling techniques and tools	21	Maximization of tools given primary hazards faced. No tools given primary hazards faced=0, 1 or more, but not all= 1, all given hazards= 2. List of choices: GIS maps, Risk profiles, others	0	21	9	21	0	9	18	3	9
Incentive based tools	29	Maximization of tools given primary hazards faced. No tools given primary hazards faced=0, 1 or more, but not all= 1, all given hazards= 2. List of choices: Land and property acquisition, retrofitting private structures, tax abatement for mitigation, density bonus, low interest loans, NFIP, others	0	29	1	29	0	1	28	1	1
Structural tools	30	Maximization of tools given primary hazards faced. No tools given primary hazards faced=0, 1 or more, but not all= 1, all given hazards= 2. List of choices: levees, seawalls, riprap or bulkheads, detention ponds, channel maintenance, slope stabilization, storm water management, sewage/drainage management, maintenance of structures, others	0	30	0	29	1	0	29	1	0
Public facilities and infrastructure	30	Maximization of tools given primary hazards faced. No tools given primary hazards faced=0, 1 or more, but not all= 1, all given hazards= 2. List of choices: capital improvement plans, retrofitting public structure, retrofitting critical facilities, others	2	28	0	30	0	0	29	1	0

		Maximization of tools given primary hazards faced. No tools given primary hazards faced=0, 1 or more, but not all= 1, all given hazards= 2. List of choices: education/training opportunities for community, staff, private stakeholders and students									
Awareness/educational tools	30	Maximization of tools given primary hazards faced. No tools given primary hazards faced=0, 1 or more, but not all= 1, all given hazards= 2. List of choices: real estate hazard disclosure, hazard notification, maps of areas subject to hazard, disaster warnings and response programs hazardous signage and related location, technical mitigation assistance, inclusion of floodplain boundaries, workshops, education/training in several languages, hazard information center, others	0	30	0	30	0	0	30	0	0
Natural resource protection	17	Maximization of tools given primary hazards faced. No tools given primary hazards faced=0, 1 or more, but not all= 1, all given hazards= 2. List of choices: general description of best management practice, forest and vegetation management of riparian areas, sediment and erosion control, stream dumping regulations, urban forestry and landscapes, soil conservation and steep slope preservation, dune preservation, wetland protection and preservation, other	0	17	13	16	1	13	11	6	13

APPENDIX C. FULL SCORE SUMMARY OF ALL COUNTIES

		Base Plan Components				Mitigation Plan components			
County Plans	State	Inclusion score (out of 13)	Comprehensiveness score (out of 76)	Internal compatibility (out of 26)	Clarity (out of 26)	Inclusion (out of 8)	Comprehensiveness (Out of 16)	Internal compatibility (Out of 16)	Clarity (out of 16)
Cass	ND	11	53	22	22	6	7	12	12
Hennepin	MN	10	37	19	16	8	10	15	13
Anoka	MN	8	27	16	14	8	9	16	15
Dakota	MN	10	43	18	17	7	7	14	14
Ramsey	MN	10	34	20	20	7	7	14	14
St. Louis	MN	11	30	22	19	8	9	16	14
Washington	MN	11	39	22	19	8	8	16	14
Winnebago	IL	11	35	22	20	7	8	14	11
Olmsted	MN	10	32	20	20	8	9	16	16
Dane	WI	7	12	12	10	7	7	14	14
Fond du Lac	WI	10	29	20	19	7	7	14	14
La Crosse	WI	10	25	20	15	8	9	16	15
Scott	MN	11	35	21	20	8	9	16	15
Carver	MN	9	32	18	14	7	7	13	12
Johnson	IA	10	27	20	18	7	7	14	14
Linn	IA	10	28	18	15	6	6	12	12
Outagamie	WI	9	26	18	17	7	7	14	14
Sheboygan	WI	9	33	18	17	7	8	14	14
Champaign	IL	12	39	21	20	6	7	12	12
Kendall	IL	11	32	21	21	7	8	12	13
Marathon	WI	10	29	18	17	6	7	12	12
Sangamon	IL	10	41	20	19	6	6	12	11
Macon	IL	9	32	18	16	6	6	12	12
Kankakee	IL	11	33	22	19	7	8	14	14
DuPage	IL	10	34	20	19	8	9	16	16
Black hawk	IA	10	38	20	19	8	9	16	16
Cook	IL	12	51	23	24	8	9	16	15
Woodbury	IA	11	41	22	20	6	7	12	12
Milwaukee	WI	11	43	22	21	8	9	16	16
Dekalb	IL	10	34	20	18	8	9	16	16