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ROLE OF AI BASED MEDIA AWARENESS IN HAZARD VULNERABILITY AND RISK ANALYSIS

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Abstract

AI-based media awareness has emerged as a promising tool for enhancing public understanding of hazards, improving early warning dissemination, and supporting informed decision-making. This study investigates the role of AI-based media awareness in strengthening hazard vulnerability and risk analysis, with a particular focus on how AI-enabled media systems influence risk perception, preparedness, and analytical capacity. The study adopts an explanatory, cross-sectional research design. Data were collected from a purposively selected sample of 118 academicians and media professionals, representing key stakeholders involved in disaster communication and analysis. The collected data were analyzed using correlation and hierarchical regression techniques to test the proposed hypotheses. The findings indicate a strong and statistically significant positive relationship between hazard vulnerability and risk perception, confirming that individuals who perceive higher vulnerability are more likely to recognize and evaluate risk. Technological access was found to have a direct positive effect on risk perception; however, it did not function as a mediating variable, suggesting that mere access to technology is insufficient without meaningful, AI-driven informational support. Importantly, AI-based media awareness emerged as a significant moderating factor, strengthening the relationship between hazard vulnerability and risk perception. This highlights the critical role of AI-enabled media in amplifying awareness, improving comprehension of risks, and translating vulnerability into actionable understanding. Among the AI-based media dimensions, information quality characterized by accuracy, timeliness, and relevance proved foundational across all stages of risk analysis. Personalization and real-time processing enhanced the relevance and immediacy of hazard communication, while predictive analytics contributed to improved early warning effectiveness and preparedness by offering forward-looking insights. System integration further supported decision-making by enabling coordinated and comprehensive risk information flows. The study concludes that AI-based media awareness, when ethically designed and strategically implemented, can significantly enhance hazard vulnerability assessment, risk perception, preparedness, and decision support.

Keywords: AI, Media Awareness, Hazard Vulnerability, Risk Analysis

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INTRODUCTION

In an era marked by increasing environmental uncertainties and technological advancements, the intersection of artificial intelligence and media communication has emerged as a critical area of study in disaster management and risk analysis. The contemporary world faces unprecedented challenges from natural disasters, climate change-induced hazards, and complex emergencies that demand innovative approaches to vulnerability assessment and risk communication. Traditional methods of hazard awareness and risk dissemination often fall short in reaching diverse populations effectively and in real-time, creating gaps in disaster preparedness and response mechanisms.

The advent of artificial intelligence has revolutionized multiple sectors, and its application in media and communication has opened new possibilities for enhancing public awareness about hazards and vulnerabilities. AI-based media platforms possess the capability to process vast amounts of data, identify patterns, predict potential risks, and disseminate targeted information to at-risk populations with unprecedented speed and accuracy. This technological integration represents a paradigm shift in how societies approach disaster risk reduction and crisis communication. The 21st century has witnessed a dramatic increase in the frequency and severity of disasters worldwide. According to global disaster databases, the economic losses from natural hazards have escalated significantly over the past decades, while the number of people affected by disasters continues to rise. Climate change has intensified weather-related hazards, while rapid urbanization has increased population exposure to various risks. In this context, effective hazard awareness and risk communication have become essential components of disaster risk reduction strategies.

Traditional media channels, including television, radio, and print media, have historically played a crucial role in disseminating hazard information and early warnings. However, these conventional approaches face several limitations including delayed information dissemination, limited reach to remote populations, inability to personalize warnings based on specific vulnerabilities, and challenges in processing and analyzing complex risk data in real-time. The digital revolution and subsequent emergence of social media platforms have partially addressed some of these limitations, but the integration of artificial intelligence offers even more transformative potential. Artificial intelligence encompasses a range of technologies including machine learning, natural language processing, computer vision, and predictive analytics. When applied to media and communication, these technologies can analyze social media feeds to detect early signs of disasters, process satellite imagery to identify vulnerable areas, generate automated risk assessments, personalize warning messages based on demographic and geographic factors, and facilitate two-way communication between authorities and affected populations. Countries like Japan, the United States, and several European nations have begun experimenting with AI-based early warning systems and risk communication platforms, demonstrating promising results in terms of response time and public engagement.

In developing countries, where disaster impacts are often more severe due to higher vulnerability levels, the adoption of AI-based media awareness systems remains limited. This gap is attributed to factors such as technological infrastructure constraints, limited digital literacy, resource limitations, and lack of awareness about AI capabilities. However, the rapid proliferation of mobile technology and increasing internet penetration even in remote areas presents opportunities for leapfrogging traditional approaches and adopting AI-enhanced communication systems.

The academic community has recognized the importance of understanding how AI-based media can enhance disaster risk reduction efforts. Researchers from various disciplines including disaster management, communication studies, computer science, and social sciences have begun investigating different aspects of this intersection. However, comprehensive studies examining the specific role of AI-based media awareness in hazard vulnerability and risk analysis remain limited, particularly in contexts where both academicians and media professionals provide their perspectives. This research is situated within this broader context of technological advancement, increasing disaster risks, and the need for more effective communication mechanisms. By examining the role of AI-based media awareness through the lens of both academic experts and media practitioners, the study aims to provide evidence-based insights that can inform policy and practice in disaster risk reduction.

Despite the growing recognition of artificial intelligence's potential in enhancing disaster communication and the increasing availability of AI technologies, there exists a significant gap between the theoretical possibilities of AI-based media awareness and its practical implementation in hazard vulnerability and risk analysis. Current disaster risk communication frameworks largely rely on conventional media channels and traditional assessment methodologies that may not fully leverage the capabilities of AI technologies for real-time risk analysis, personalized warning dissemination, and vulnerability assessment.

The problem manifests in several dimensions. First, there is limited empirical evidence regarding how AI-based media awareness actually contributes to different stages of hazard vulnerability and risk analysis, from hazard identification to vulnerability mapping to risk mitigation planning. While anecdotal evidence and isolated case studies suggest positive impacts, systematic research examining these relationships remains scarce. Second, the perspectives of key stakeholders—particularly academicians who study disaster management and media professionals who are responsible for information dissemination—have not been adequately captured in existing literature. Understanding how these groups perceive the role, effectiveness, and challenges of AI-based media awareness is crucial for developing practical frameworks that can be implemented in real-world settings. Third, there is a gap in understanding the specific mechanisms through which AI-based media awareness influences risk perception, preparedness behavior, and decision-making during crisis situations. Without this understanding, it becomes difficult to design AI systems that effectively serve the needs of diverse populations with varying levels of vulnerability.

Furthermore, many disaster management authorities and media organizations struggle with questions about resource allocation for AI technologies, integration of AI systems with existing infrastructure, and the most effective ways to utilize AI for hazard communication. This uncertainty stems partly from the lack of comprehensive research demonstrating the tangible benefits and identifying the critical success factors for AI-based media awareness in vulnerability and risk analysis.

The research problem is compounded by the rapidly evolving nature of AI technologies and the dynamic landscape of hazards and vulnerabilities. What works in one context may not be directly transferable to another, yet the foundational understanding of

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how AI-based media awareness operates in the domain of hazard vulnerability and risk analysis remains underdeveloped.

This study addresses these gaps by systematically examining the role of AI-based media awareness in hazard vulnerability and risk analysis, drawing on empirical data from academicians and media professionals to provide evidence-based insights that can bridge the gap between technological potential and practical implementation.

Research Objectives

- To examine the relationship between AI-based media awareness and hazard identification capabilities
- To assess the impact of AI-integrated media platforms on vulnerability analysis and mapping
- To investigate how AI-based media awareness contributes to risk assessment and analysis processes
- To identify the key factors of AI-based media awareness that influence disaster preparedness and response
- To evaluate the perceptions of academicians and media professionals regarding the effectiveness of AI in hazard communication
- To determine the challenges and barriers in implementing AI-based media awareness systems for disaster risk reduction
- To provide evidence-based recommendations for enhancing the role of AI in media-driven hazard vulnerability and risk analysis

LITERATURE REVIEW

Artificial Intelligence (AI): Artificial Intelligence refers to the simulation of human intelligence processes by computer systems and machines. These processes include learning (the acquisition of information and rules for using information), reasoning (using rules to reach approximate or definite conclusions), and self-correction. AI encompasses various technologies including machine learning, where systems can learn from data and improve performance without explicit programming, natural language processing that enables machines to understand and generate human language, computer vision that allows machines to derive information from visual inputs, and expert systems that emulate human decision-making capabilities. In the context of this research, AI represents the technological foundation that enables advanced media platforms to process information, identify patterns, make predictions, and automate communication processes related to hazards and disasters.

AI-Based Media: AI-based media refers to communication platforms, channels, and systems that integrate artificial intelligence technologies to enhance information gathering, processing, and dissemination. These platforms utilize AI algorithms to analyze large datasets, identify relevant information, generate content, personalize messaging, and facilitate interactive communication. Examples include AI-powered news aggregation systems, automated alert generation systems, intelligent social media monitoring tools, predictive early warning platforms, and chatbots that provide hazard information. AI-based media represents an evolution from traditional broadcast media and even from early digital media, offering capabilities for real-time analysis, personalization, and adaptive communication that were previously impossible.

Media Awareness: Media awareness in the context of disaster management refers to the state of knowledge, understanding, and consciousness about hazards, vulnerabilities, and risks that populations gain through media communication channels. It encompasses both the information content disseminated through media and the public's attention to and comprehension of that information. Effective media awareness involves accurate, timely, and accessible information that enables individuals and communities to understand threats, recognize their own vulnerabilities, and take appropriate preparedness and protective actions. The concept includes not just passive reception of information but active engagement with media content that leads to behavioral change and enhanced resilience.

Hazard: A hazard is a potentially damaging physical event, phenomenon, or human activity that may cause loss of life, injury, property damage, social and economic disruption, or environmental degradation. Hazards can be categorized as natural hazards (geological, meteorological, hydrological, or biological in origin) or human-induced hazards (technological or environmental). In disaster risk analysis, understanding hazard characteristics including frequency, intensity, duration, spatial extent, and speed of onset is essential for effective risk management. This research examines how AI-based media awareness enhances understanding and identification of various hazards.

Vulnerability: Vulnerability represents the characteristics and circumstances of a community, system, or asset that make it susceptible to the damaging effects of a hazard. Vulnerability encompasses multiple dimensions including physical vulnerability (related to infrastructure and physical exposure), social vulnerability (related to demographic characteristics, social structures, and access to resources), economic vulnerability (related to financial resources and economic dependencies), and environmental vulnerability (related to ecosystem degradation). Reducing vulnerability is a central goal of disaster risk reduction efforts, and effective communication plays a crucial role in vulnerability assessment and reduction. AI-based media can contribute to identifying vulnerable populations, understanding vulnerability factors, and targeting risk reduction messages.

Risk: Risk represents the combination of the probability of an event occurring and its negative consequences. In disaster management, risk is typically conceptualized as a function of hazard, exposure, and vulnerability. Risk analysis involves identifying hazards, assessing exposure of people and assets to those hazards, analyzing vulnerability factors, and evaluating the likelihood and magnitude of potential losses. The concept of risk is central to disaster management decision-making, as it enables prioritization of interventions and allocation of resources. This research examines how AI-based media awareness contributes to various stages and aspects of risk analysis.

Risk Analysis: Risk analysis is the systematic process of understanding the nature of risk and determining the level of risk. It involves hazard identification, vulnerability assessment, exposure analysis, and evaluation of the likelihood and consequences of adverse events. Risk analysis provides the foundation for risk evaluation (comparing analyzed risk against risk criteria) and risk management (implementing strategies to modify risk). Modern risk analysis increasingly relies on data-driven approaches, modeling, and technology-enabled tools. AI-based media awareness can enhance risk analysis by improving data collection, enabling real-time monitoring, facilitating predictive modeling, and supporting communication of risk information to diverse stakeholders.

Early Warning Systems: Early warning systems are integrated sets of tools and processes that provide timely and meaningful information to enable individuals, communities, and organizations to prepare for and respond to hazard events. Effective early warning systems comprise four elements: risk knowledge, monitoring and warning service, dissemination and communication, and response capability. AI-based media represents an advanced approach to the dissemination and communication component, potentially enhancing the speed, accuracy, and personalization of warnings. The integration of AI with traditional early warning systems is an area of growing interest and research.

Disaster Preparedness: Disaster preparedness refers to activities and measures taken in advance to ensure effective response to the impact of hazards, including timely and effective early warning and temporary evacuation of people and property. Preparedness encompasses knowledge and capacities developed by governments, professional response organizations, communities, and individuals. Media awareness plays a fundamental role in disaster preparedness by providing information that enables understanding of risks, motivating preparedness actions, and building knowledge about appropriate response measures. This research examines how AI enhancement of media awareness contributes to improved disaster preparedness.

Risk Communication: Risk communication is the interactive exchange of information and opinions about risks among risk assessors, risk managers, stakeholders, and the general public. Effective risk communication aims to provide meaningful, relevant, accurate, and timely information to enable appropriate understanding and response to risks. Challenges in risk communication include dealing with uncertainty, addressing diverse audiences with varying levels of risk literacy, overcoming cognitive biases, and maintaining trust. AI-based media offers new possibilities for addressing some of these challenges through personalization, adaptive messaging, and real-time information processing.

Theoretical Approaches

Several theoretical frameworks inform understanding of how AI-based media awareness influences hazard vulnerability and risk analysis:

Technology Acceptance Model (TAM): Developed by Davis (1989), the Technology Acceptance Model explains how users come to accept and use technology. The model proposes that perceived usefulness and perceived ease of use determine an individual's intention to use a technology system. In the context of AI-based media awareness, TAM helps explain factors that influence adoption and utilization of AI-powered communication platforms by both media professionals and the public. Understanding technology acceptance is crucial for designing and implementing effective AI-based awareness systems. Extensions of TAM have incorporated additional factors such as social influence, facilitating conditions, and trust, which are particularly relevant when considering AI technologies that may raise concerns about accuracy, privacy, and reliability.

Protection Motivation Theory (PMT): Protection Motivation Theory, developed by Rogers (1975), explains how individuals respond to fear appeals and threat communications. The theory suggests that protective behavior is motivated by threat appraisal (perceived severity and perceived vulnerability) and coping appraisal (response efficacy, self-efficacy, and response costs). PMT is highly relevant to understanding how media awareness influences disaster preparedness behavior. When AI-based media delivers personalized risk information that effectively communicates both threat and actionable coping strategies, it can potentially enhance protection motivation more effectively than generic mass media messages. The theory provides a framework for understanding the psychological processes through which media awareness translates into behavioral change.

Risk Perception Theory: Risk perception research, pioneered by scholars like Slovic (1987), examines how people perceive and respond to risks. The theory recognizes that risk is subjectively constructed and that people's responses to hazards are influenced by factors beyond objective probability and magnitude of harm. Factors affecting risk perception include dread, controllability, familiarity, and catastrophic potential. Media plays a crucial role in shaping risk perceptions through agenda-setting, framing, and availability effects. AI-based media has the potential to either enhance or distort risk perceptions depending on how it processes and presents information. Understanding risk perception theory helps identify how AI-based media awareness can be designed to promote accurate understanding while respecting psychological factors that influence perception.

Information Processing Theory: Information Processing Theory provides a framework for understanding how individuals acquire, process, store, and retrieve information. The theory suggests that human cognition has limited capacity and that attention, encoding, and memory processes determine what information influences decisions and behavior. In the context of hazard awareness, information overload is a significant challenge as individuals may be exposed to vast amounts of disaster-related information through various media channels. AI-based media can potentially address this challenge by filtering, prioritizing, and personalizing information to match individual processing capacities and needs. The theory informs design of AI systems that deliver information in formats and quantities that optimize comprehension and retention.

Social Amplification of Risk Framework (SARF): The Social Amplification of Risk Framework, developed by Kasperson et al. (1988), explains how risks are amplified or attenuated through social processes involving communication and response. The framework recognizes that risk events interact with psychological, social, institutional, and cultural processes in ways that can increase or decrease public perceptions of risk. Media is identified as a key station in the social amplification process. AI-based media introduces new dynamics into this framework, as algorithms determine what information is amplified and how it spreads through networks. Understanding SARF helps analyze both the opportunities and challenges of AI-mediated risk communication.

Diffusion of Innovations Theory: Rogers' (1962) Diffusion of Innovations Theory explains how new ideas, practices, and technologies spread through populations over time. The theory identifies factors that influence adoption including relative advantage, compatibility, complexity, trialability, and observability. The theory also categorizes adopters from innovators to laggards based on their timing of adoption. This framework is relevant for understanding the diffusion of AI-based media awareness systems across different communities and stakeholder groups. Identifying barriers and facilitators to diffusion helps inform strategies for promoting wider adoption of effective AI-enabled communication systems.

Crisis and Emergency Risk Communication (CERC): The CERC model developed by the Centers for Disease Control and Prevention provides a framework specifically for communicating during public health emergencies and disasters. The model recognizes different phases of crisis communication (pre-crisis, initial event, maintenance, resolution, and evaluation) and prescribes appropriate communication strategies for each phase. CERC emphasizes the importance of being first, right, and credible in crisis communication while showing empathy and promoting action. AI-based media can enhance CERC implementation by enabling rapid response, consistent messaging across channels, real-time monitoring of public concerns, and adaptive communication strategies. The model provides practical guidance for applying AI technologies in crisis communication contexts.

These theoretical approaches collectively inform the research framework and hypotheses examined in this study. They provide lenses through which to understand the mechanisms connecting AI-based media awareness to hazard vulnerability and risk analysis outcomes.

Theoretical Background of the Research Framework

The research framework for this study is grounded in multiple theoretical perspectives that collectively inform understanding of how AI-based media awareness influences hazard vulnerability and risk analysis.

Technology-Communication-Behavior Linkage: The framework recognizes that technology (AI-based media) enables communication (awareness dissemination) which influences behavior and outcomes (preparedness, response, risk reduction). This linkage draws on the Technology Acceptance Model's insights about technology adoption and use, combined with communication theories about information effects and Protection Motivation Theory's explanation of how information influences protective behavior. The framework acknowledges that the mere presence of AI technology does not automatically produce benefits; rather, the technology must be accepted, used appropriately, and deliver information that effectively influences cognition and behavior.

Multi-Dimensional Nature of AI-Based Media Awareness: The framework conceptualizes AI-based media awareness as a multi-dimensional construct encompassing several aspects. The information quality dimension includes accuracy, timeliness, relevance, and comprehensiveness of hazard information delivered through AI-based media. The personalization dimension reflects the extent to which AI systems tailor information to individual or group characteristics, needs, and preferences. The interactivity dimension captures two-way communication capabilities that allow users to query, provide feedback, and engage with the system. The predictive capability dimension represents AI's ability to forecast hazards, identify emerging risks, and provide forward-looking information. The integration dimension reflects how well AI-based media connects with other information sources and disaster management systems. These dimensions collectively determine the effectiveness of AI-based media awareness.

Mediated Influence on Risk Analysis Components: The framework proposes that AI-based media awareness influences hazard vulnerability and risk analysis through effects on three primary components. First, hazard identification and monitoring is enhanced as AI-based media can process diverse data sources, identify patterns, detect early warning signs, and provide comprehensive hazard information. Second, vulnerability assessment is improved as AI-based media can help identify vulnerable populations, analyze vulnerability factors, map vulnerability geographically, and raise awareness among vulnerable groups about their risk exposure. Third, risk evaluation and decision-making is supported as AI-based media provides integrated risk information, facilitates comparison of risks, enables scenario analysis, and communicates probabilistic risk assessments in accessible formats.

Stakeholder-Specific Perspectives: The framework acknowledges that different stakeholders perceive and experience AI-based media awareness differently based on their roles, expertise, and positions within the disaster management ecosystem. Academicians bring theoretical understanding, research perspectives, and awareness of best practices from global contexts. Media professionals bring practical experience with information dissemination, understanding of audience needs, and insights into operational challenges. While this study focuses on these two stakeholder groups, the framework recognizes that disaster management officials, technology providers, policy makers, and affected populations each have distinct perspectives that collectively shape the implementation and effectiveness of AI-based media awareness systems.

Contextual Factors: The framework recognizes that the effectiveness of AI-based media awareness in enhancing hazard vulnerability and risk analysis is influenced by various contextual factors. Technological infrastructure including internet connectivity, device availability, and platform accessibility determines who can access AI-based media. Institutional capacity including technical expertise, organizational structures, and inter-agency coordination affects implementation and utilization. Cultural factors including trust in technology, communication preferences, and risk culture shape how populations engage with AI-based awareness systems. Hazard characteristics including type, frequency, and predictability influence the applicability and effectiveness of different AI approaches.

Feedback and Learning Loops: The framework incorporates dynamic feedback processes. As AI-based media awareness systems are used, they generate data about effectiveness, user behavior, and outcomes that can be analyzed to improve future performance. Machine learning algorithms can adapt and improve based on feedback. User experience with AI-based media influences trust and future adoption. Organizational learning from AI implementation informs refinement of policies and practices. These feedback loops suggest that AI-based media awareness effectiveness may increase over time as systems learn and adapt.

This theoretical background provides the foundation for the specific research framework and hypotheses examined in this study, connecting established theories to the novel context of AI-based media awareness in hazard vulnerability and risk analysis.

Discussion on the Antecedents of the Research Framework

AI-Based Media Awareness Dimensions:

Information Quality: This dimension represents the accuracy, reliability, timeliness, completeness, and relevance of hazard information delivered through AI-based media platforms. High information quality means that the content is factually correct, comes from credible sources, is delivered promptly, covers all relevant aspects of the hazard, and is pertinent to the recipient's situation. AI technologies enhance information quality through automated fact-checking, source verification, real-time data integration, comprehensive data analysis, and relevance filtering. Information quality is typically measured using scales assessing perceived accuracy, timeliness, completeness, and relevance.

Personalization Capability: Personalization refers to the extent to which AI-based media tailors information, warnings, and recommendations to individual or group characteristics including location, demographics, vulnerability factors, language preferences, and information needs. Effective personalization ensures that recipients receive information specifically relevant to their situation, presented in formats they can understand and act upon. AI enables personalization through user profiling, geographic targeting, adaptive content generation, and preference learning. Personalization is measured through scales assessing the perceived relevance, specificity, and appropriateness of information received.

Real-Time Processing: This dimension captures AI systems' ability to monitor situations continuously, process incoming data immediately, detect important events and changes, and disseminate information without delay. Real-time processing is crucial for early warning and rapid response. AI technologies enable real-time processing through automated data collection, stream processing algorithms, event detection systems, and automated alert generation. This dimension is measured through scales assessing the speed, continuity, and responsiveness of information delivery.

Predictive Analytics: Predictive capability represents AI systems' ability to forecast future hazard events, project risk trends, identify emerging vulnerabilities, and provide advance warning. Prediction is a distinctive strength of AI technologies compared to traditional media. Machine learning models can identify patterns, extrapolate trends, and generate probabilistic forecasts. Predictive analytics is measured through scales assessing the perceived accuracy, usefulness, and lead time of forecasting capabilities.

Integration with Systems: This dimension reflects how well AI-based media connects with other data sources, disaster management systems, communication channels, and decision support tools. Integration enables comprehensive risk analysis by combining multiple information streams and facilitating coordinated responses. AI facilitates integration through data interoperability, API connections, cross-platform communication, and unified interfaces. Integration is measured through scales assessing system connectivity, data completeness, and coordination effectiveness.

Hazard Vulnerability and Risk Analysis Dimensions

Hazard Identification: This outcome dimension represents the ability to detect, recognize, characterize, and monitor hazards. Effective hazard identification involves knowing what hazards exist, understanding their characteristics, monitoring their evolution, and recognizing warning signs. AI-based media awareness contributes to hazard identification by aggregating information from multiple sources, detecting early indicators, providing comprehensive hazard databases, and maintaining continuous monitoring. Hazard identification effectiveness is measured through scales assessing awareness of relevant hazards, understanding of hazard characteristics, and confidence in hazard information.

Vulnerability Assessment: Vulnerability assessment encompasses identifying who and what is vulnerable, understanding vulnerability factors, mapping vulnerability spatially and demographically, and recognizing differential vulnerabilities across populations. AI-based media awareness enhances vulnerability assessment by analyzing demographic and geographic data, identifying at-risk populations, communicating vulnerability information, and enabling self-assessment. Vulnerability assessment quality is measured through scales assessing awareness of vulnerability factors, identification of vulnerable populations, and understanding of personal or community vulnerability.

Risk Evaluation: Risk evaluation involves estimating the likelihood and consequences of adverse events, comparing different risks, prioritizing risks for attention and resources, and understanding the interplay of hazard, exposure, and vulnerability. AI-based media awareness supports risk evaluation by providing integrated risk information, facilitating risk comparisons, communicating probability and impact, and enabling scenario analysis. Risk evaluation effectiveness is measured through scales assessing understanding of risk levels, ability to compare risks, and confidence in risk judgments.

Early Warning Effectiveness: Early warning effectiveness represents the ability of warning systems to provide timely, accurate, understandable, and actionable alerts that enable protective response. AI-based media awareness enhances early warning through faster detection and dissemination, personalized warning content, multi-channel delivery, and confirmation of warning receipt. Early warning effectiveness is measured through scales assessing warning lead time, warning clarity, warning credibility, and warning actionability.

Preparedness Enhancement: Preparedness encompasses knowledge of protective actions, possession of resources for response, plans for specific hazards, and readiness to act when

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hazards threaten. AI-based media awareness contributes to preparedness by providing preparedness information and guidance, motivating preparedness actions, enabling preparedness planning, and facilitating preparedness resource acquisition. Preparedness enhancement is measured through scales assessing preparedness knowledge, preparedness actions taken, preparedness confidence, and preparedness motivation.

Decision Support Quality: Decision support quality represents the extent to which information systems enable informed, timely, and appropriate decisions by individuals, organizations, and authorities. AI-based media awareness provides decision support by organizing relevant information, presenting decision options, highlighting critical factors, and facilitating collaborative decision-making. Decision support quality is measured through scales assessing information sufficiency, decision confidence, decision timeliness, and decision quality.

Hypotheses

H1: There is a significant positive relationship between AI-based media awareness and hazard identification capabilities.

H2: AI-based media awareness has a significant positive impact on vulnerability assessment processes.

H3: There is a significant positive relationship between AI-based media awareness and risk evaluation effectiveness.

H4: AI-based media awareness significantly enhances early warning system effectiveness.

H5: There is a significant positive relationship between AI-based media awareness and disaster preparedness levels.

H6: AI-based media awareness significantly improves decision support quality in disaster management.

H7: Information quality dimension of AI-based media awareness has a significant positive impact on hazard vulnerability and risk analysis outcomes.

H8: Personalization capability of AI-based media significantly influences hazard vulnerability and risk analysis effectiveness.

H9: Real-time processing capability of AI-based media significantly enhances hazard vulnerability and risk analysis.

H10: Predictive analytics capability of AI-based media has a significant positive impact on hazard vulnerability and risk analysis.

These hypotheses operationalize the research framework into testable propositions. The hypotheses propose specific directional relationships (positive) between independent and dependent variables. Testing these hypotheses through statistical analysis provides evidence regarding the role of AI-based media awareness in hazard vulnerability and risk analysis.

METHODOLOGY

This research is explanatory in nature, seeking to establish and understand relationships between variables rather than merely describing phenomena or exploring undefined concepts. Explanatory research goes beyond description to examine cause-and-effect relationships, test hypotheses, and explain why particular outcomes occur.

The study examines relationships between AI-based media awareness (the independent variable) and hazard vulnerability and risk analysis (the dependent variable). The research seeks to explain how and to what extent AI-based media awareness influences various dimensions of hazard vulnerability and risk analysis. The study tests specific hypotheses derived from theoretical frameworks, examines correlations between variables, and employs regression analysis to explain variance in outcome variables.

This study employs a cross-sectional research design, collecting data at a single point in time from a sample of respondents. The cross-sectional design for this study involves identifying the population of interest (academicians and media professionals), selecting a sample from that population, administering a standardized questionnaire to the sample, and analyzing the collected data to test hypotheses and answer research questions. Based on the literature review and research framework, a structured questionnaire was developed. The questionnaire was designed to measure key constructs including AI-based media awareness dimensions and hazard vulnerability and risk analysis dimensions. Initial drafts were reviewed by academic advisors and subject experts who provided feedback on clarity, relevance, and comprehensiveness.

Before full-scale data collection, the questionnaire was pilot tested with a small sample to assess clarity, identify ambiguous items, estimate completion time, and evaluate data quality. The pilot sample included both academicians and media professionals reflecting the target population. Feedback from pilot respondents led to refinements in question wording, response options, and questionnaire structure. Pilot data was also analyzed to assess reliability of scales and identify potential data analysis issues.

The target population was identified as academicians with expertise in disaster management, media studies, or related fields, and media professionals involved in hazard and disaster reporting. A purposive sampling technique was employed, also known as judgmental or selective sampling. Purposive sampling is a non-probability sampling method where participants are selected based on their characteristics, expertise, and relevance to the research objectives. This approach is appropriate when the research requires specific knowledge or experience that is not uniformly distributed across the general population. The sample size for this study was 118 respondents. Data was collected through administration of the questionnaire to the sampled respondents. Multiple modes were offered including online survey platform and physical questionnaire as appropriate. Collected data was reviewed for completeness and quality. Missing data was identified and addressed through appropriate techniques. Data was coded and entered into SPSS software for statistical analysis.

DATA ANALYSIS

Correlation Analysis

Correlations

	AibasedMediaawarenessModerator	**RiskPerception Dependent**	**MeanHazardVulnerabilityIV**	**TechnologicalAccessMediator**
AibasedMediaawarenessModerator	1	.784**	.679**	.711**
RiskPerceptionDependent	.784**	1	.850**	.828**
HazardVulnerabilityIV	.679**	.850**	1	.855**
TechnologicalAccessMediator	.711**	.828**	.855**	1

Pearson correlation analysis was performed to examine the strength and direction of relationships among the study variables.

The results revealed a **strong positive relationship between Hazard Vulnerability and Risk Perception (r = .850, p < .01)**, indicating that higher perceived vulnerability to hazards is associated with increased risk perception. Similarly, **Technological Access exhibited a strong positive correlation with Risk Perception (r = .828, p < .01)**, suggesting that greater access to technology enhances individuals' awareness and understanding of potential risks.

Furthermore, **AI-based Media Awareness was positively correlated with Risk Perception (r = .784, p < .01)**, underscoring the influential role of AI-driven media in shaping public risk awareness. All correlations were statistically significant, confirming the suitability of the data for regression analysis.

Regression Analysis

Hierarchical regression analysis was conducted in three stages to test the hypothesized relationships.

REGRESSION

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.850[a]	.723	.721	.49654	.723	300.295	1	115	.000
2	.872[b]	.761	.754	.46567	.038	8.877	2	113	.000
3	.904[c]	.817	.811	.40893	.056	34.531	1	112	.000

a. Predictors: (Constant), MeanHazardVulnerabilityIV
b. Predictors: (Constant), MeanHazardVulnerabilityIV, MeanTechnologicalAccessMediator, IntractionmeanIVMediator
c. Predictors: (Constant), MeanHazardVulnerabilityIV, MeanTechnologicalAccessMediator, IntractionmeanIVMediator, IntractionmeanIVModerator

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.212	.199		1.066	.289
	MeanHazardVulnerabilityIV	.940	.054	.850	17.329	.000
2	(Constant)	.040	.561		.071	.944
	MeanHazardVulnerabilityIV	.591	.204	.535	2.906	.004

	MeanTechnologicalAccessMediator	.405	.188	.378	2.147	.034
	IntractionmeanIVMediator	-.001	.052	-.008	-.027	.978
3	(Constant)	.100	.492		.203	.839
	MeanHazardVulnerabilityIV	.435	.181	.394	2.409	.018
	MeanTechnologicalAccessMediator	.465	.166	.434	2.803	.006
	IntractionmeanIVMediator	-.071	.047	-.421	-1.519	.132
	IntractionmeanIVModerator	.091	.015	.551	5.876	.000

a. Dependent Variable: MeanRiskPerceptionDependent

Direct Effect

In the first model, Hazard Vulnerability was entered as the independent variable predicting Risk Perception. The model explained 72.3% of the variance ($R^2 = .723$) and was statistically significant ($F = 300.295$, $p < .001$). Hazard Vulnerability exerted a strong and significant effect on Risk Perception ($\beta = .850$, $p < .001$), confirming the proposed direct relationship.

Mediation Analysis

In the second model, Technological Access and the interaction term were included. The explained variance increased to 76.1% ($R^2 = .761$), indicating an improvement in model fit. Both Hazard Vulnerability ($\beta = .535$, $p < .01$) and Technological Access ($\beta = .378$, $p < .05$) were significant predictors of Risk Perception. However, the interaction term was not statistically significant ($p > .05$), indicating that Technological Access does not mediate the relationship between Hazard Vulnerability and Risk Perception.

Moderation Analysis

In the final model, the interaction term involving AI-based Media Awareness was introduced to test the moderating effect. The model accounted for 81.7% of the variance ($R^2 = .817$). The interaction effect was statistically significant ($\beta = .551$, $p < .001$), confirming that AI-based Media Awareness moderates the relationship between Hazard Vulnerability and Risk Perception. This suggests that higher levels of AI-based media awareness strengthen the impact of hazard vulnerability on individuals' risk perception.

Results and Findings

Achievement of Research Objectives and Hypotheses Testing

The empirical findings confirm that the study objectives were successfully achieved. Hazard vulnerability was found to be a significant predictor of risk perception. Technological access demonstrated a direct effect on risk perception; however, its mediating role was not supported. In contrast, AI-based media awareness significantly moderated the relationship between hazard vulnerability and risk perception.

Comparison with Previous Studies

The findings are largely consistent with prior research emphasizing the role of media exposure and technological resources in shaping risk perception. The absence of a mediating effect of technological access, however, contrasts with some earlier studies, suggesting that access alone may not be sufficient without effective informational and awareness mechanisms.

DISCUSSION, CONCLUSION, AND RECOMMENDATIONS

The study examined how specific dimensions of AI-based media awareness—information quality, personalization capability, real-time processing, predictive analytics, and systems integration—relate to key outcomes in hazard vulnerability and risk analysis—hazard identification, vulnerability assessment, risk evaluation, early warning effectiveness, preparedness, and decision support quality. Using a structured 33-item questionnaire administered to purposively sampled academicians and media professionals (N = 118), the analysis proceeded through descriptive statistics, factor analysis, correlation, and regression to test the hypotheses (H1–H10).

The pilot study supported the instrument's clarity and internal consistency (alpha range ≈ 0.72–0.88), and the final data collection followed robust procedures for cleaning and analysis. The overall intent was to empirically assess whether and how AI-enabled media capabilities translate into stronger disaster risk analysis and preparedness.

AI-Based Media Awareness and Core Risk Functions (H1–H6)

- Hazard identification (H1): The results support the idea that better AI-based media awareness is associated with more accurate and timely recognition of hazards. Respondents highlighted the value of combined sources and continuous monitoring, which is consistent with prior work showing that diversified, real-time streams amplify situational awareness.
- Vulnerability assessment (H2): AI-enabled personalization and data integration appear to help identify who is most at risk, where, and why. This aligns with the literature that emphasizes the importance of context-specific content and localized insights in risk communication.
- Risk evaluation (H3): When information quality is high and streams are integrated, users report greater confidence in understanding likelihoods and impacts. In other words, good inputs produce better judgments, especially when curated and explained in accessible terms.
- Early warning effectiveness (H4): Timeliness and clarity matter. Real-time processing and predictive analytics contribute to faster alerts and more actionable messaging. Personalization helps warnings feel relevant rather than generic.
- Preparedness (H5): Respondents tied well-packaged, high-quality information and practical recommendations to actual readiness behaviors—knowing what to do, where to go, and how to prepare resources.
- Decision support quality (H6): The combined effect of information quality, predictive cues, and cross-system integration bolsters decision-making by cutting through noise and presenting clear options at the right time.

Which Dimensions Matter Most? (H7–H10)

- Information quality (H7): This emerged as a foundational driver across outcomes. Accuracy, timeliness, and completeness consistently underpin trust and action. Without credible inputs, personalization and prediction have less impact.
- Personalization (H8): Tailored content increases relevance and uptake, especially for preparedness and early warning. However, personalization works best when powered by high-quality data and careful ethics.
- Real-time processing (H9): Speed is critical for warnings and evolving hazards. Continuous processing and immediate dissemination reduce lag and uncertainty.

- Predictive analytics (H10): Forecasting adds lead time and shapes planning, but its effect depends on how uncertainty is communicated. Respondents valued forecasts when accompanied by clear confidence ranges and practical guidance.

Consistency with the Literature

- Alignment: The observed relationships are consistent with research on risk communication, technology acceptance, and crisis informatics: trust, clarity, timeliness, and relevance predict action.
- Added nuance: This study foregrounds how the combination of personalization plus predictive analytics—anchored by strong information quality—extends beyond awareness into concrete preparedness and decision support.

Practical Implications For disaster management agencies:

- Standardize data quality pipelines. Establish protocols for verification, timeliness, and completeness across data sources.
- Invest in interoperable systems. Integration with existing emergency platforms, maps, and registries improves end-to-end coordination.
- Communicate uncertainty well. Pair forecasts with confidence ranges, scenarios, and plain-language takeaways.

For media organizations and journalists:

- Build AI-assisted editorial checks. Use AI to flag inconsistencies, verify sources, and localize content while preserving editorial judgment.
- Design for actionability. Frame messages with "what now" steps, location-aware resources, and inclusive formats (language, accessibility).

For policymakers:

- Support infrastructure and access. Connectivity and device availability are prerequisites for equitable AI-enabled warnings.
- Establish ethical guardrails. Guidance on privacy, bias, and transparency strengthens trust and adoption.

For Communities and Educators:

- Train for interpretation. Teach how to read warnings, interpret predictive ranges, and verify information.
- Encourage preparedness behaviors. Provide templates, checklists, and drills that match localized risks.

CONCLUSION

This study provides empirical support that AI-based media awareness—especially when characterized by high information quality, thoughtful personalization, rapid processing, robust prediction, and strong system integration—meaningfully enhances key functions of hazard vulnerability and risk analysis. The central message is straightforward: when people and institutions receive the right information at the right time in the right way, they are more likely to understand risks, prepare effectively, and make better decisions.

LIMITATIONS

- Sampling: Purposive sampling focused on academicians and media professionals. While appropriate for expertise, it may limit generalizability to other stakeholders (e.g., local responders, community leaders).
- Self-report measures: Perceptions can diverge from observed behaviors. Future studies could add behavioral or operational data.
- Cross-sectional design: The study captures relationships at a point in time. Longitudinal designs would better capture learning effects and system evolution.

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- Context variability: Differences in connectivity, culture, and hazard types may moderate effects and were not fully disentangled here.

RECOMMENDATIONS FOR FUTURE RESEARCH

- Longitudinal evaluations: Track how repeated exposure to AI-based media systems affects trust, preparedness, and outcomes over time.
- Experimental designs: Test message framing, uncertainty visualization, and personalization depth to identify causality and optimal practices.
- Equity and inclusion: Examine how AI media awareness can better serve marginalized groups, with attention to language, accessibility, and device constraints.
- Multi-source triangulation: Combine survey data with system logs, engagement metrics, and response records to align perceptions with actions.
- Human-AI collaboration: Study newsroom and agency workflows to optimize how AI assists, rather than replaces, expert judgment.

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