Scientific Research Publishing

Open Journal of Applied Sciences, 2023, 13, 858-873
https://www.scirp.org/journal/ojapps
ISSN Online: 2165-3925
ISSN Print: 2165-3917

Application of Social Media Tool in Disaster Management in Disaster-Prone Communities in Freetown, Sierra Leone

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How to cite this paper: Sawaneh, I.A., Fan, L. and Sesay, B. (2023) Application of Social Media Tool in Disaster Management in Disaster-Prone Communities in Freetown, Sierra Leone. *Open Journal of Applied Sciences*, **13**, 858-873.
https://doi.org/10.4236/ojapps.2023.136069

Received: November 13, 2022
Accepted: June 22, 2023
Published: June 25, 2023

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Abstract

This study used both the "digital divide" and "attribution theory" to analyze the propensity of social media use by disaster-prone communities. The study focused on the variables that may affect how social media is used for disaster management. Structural equation modeling (SEM) was utilized in the study to analyze the data and test the hypotheses after using a survey questionnaire to collect the data. The study's findings show that: 1) communities that are vulnerable to disasters are less likely to use social media for disaster management, 2) personal effort and intention to use social media for disaster management are positively correlated, and 3) task complexity and intention to use social media for disaster management are negatively correlated. The study added to the body of knowledge regarding the role social media plays in disaster management.

Keywords

Social Media Use, Disaster Management, Disaster-Prone Community, Task Complexity, Ability, Effort

1. Introduction

Within disaster management, disaster communication is a particularly dynamic field. Since there are so many different and developing ways that individuals use media during disasters, it is extremely difficult to capture the state of the art in this field. According to [1] [2] [3] [4], organizations and people involved in disaster management are optimistic about using social media to improve communication and operations during disaster management. They frequently use social

media and their social networks to find and provide information necessary for making vital decisions like paying attention to warnings and organizing evacuations [5]. Social media have changed in recent years from being merely a passive medium of information exchange—that is, merely disseminating static information of disaster occurrence—to an active emergency tool that has the capability of disseminating real-time warning information, creating real-time situational awareness of user activities, and receiving requests for assistance [6] [7]. The benefits of social media, such as their usability, effectiveness as a communication tool, and ability to facilitate free and open information exchange online, have increased their usage in disaster management [3] [8] [9] [10]. Social media has been used in disaster management to gather information for analyzing crises and creating operational pictures, coordinating rescue activities, and disseminating important information to as many people as possible [11].

All communities cannot equally benefit from the use of social media as essential instruments for communication and collaboration in disaster management and relief because of social disparity in access to and use of social media data [6] [7]. The "digital divide", which describes the gap between those with access to information and communication technology and those without it [12] [13], is a result of socioeconomic inequality. A "disaster-prone or vulnerable community" is a group of people who do not have access to certain technologies, have trouble using them to gather information, or cannot respond to emergencies in the same way as the general public [12] [13] [14]. Some of the groups who come under the category of disaster-prone or vulnerable communities include those who are from lower socioeconomic classes, people with disabilities, the elderly, the lonely, and those who are marginalized. Such groups generally suffer disproportionately from disasters, according to research [15] [16] [17]. They are always informed in advance of the locations and safety instructions, much to how floods during the rainy seasons disproportionately affected disaster-prone communities, according to [17]. People in these underprivileged neighborhoods were unable to benefit from these instructions, because they lacked the requisite abilities and technological knowledge [18].

There is still a gap in the literature when it comes to explaining the ineffectiveness of the use of social media by disaster-prone communities for disaster management even though the use of social media for disaster management has been thoroughly studied [3] [10] [19]. Investigating the factors that influence this behavior may be the first step in trying to close the digital divide and promote the use of social media for disaster management in disaster-prone communities.

This study determined the tendency of using social media by a sample of disaster-prone communities in Freetown, Sierra Leone, and explored the factors that can influence the use of social media for disaster management, noting the literature on the "digital divide" and "attribution theory". Five hypotheses were developed. The first four hypotheses investigate, how social media use (ability, effort, and task complexity) and disaster-prone communities impact their intention to adopt social media technology in disaster management. The moderating

role of disaster-prone communities in the relationship between task complexity and social media use for disaster management is examined in the fifth hypothesis. Data was collected using a survey questionnaire. The data collected was examined using the structural equation model (SEM) approach.

After the introduction, the paper is organized as follows: we discussed the theoretical framework and model development, generating five hypotheses while consulting the literature on the "digital divide" and "attribution theory". The approach utilized to gather the data and test the hypotheses is then presented. We presented the data analysis and explained the findings in the sections that follow, after which we explored how the study has consequences for theory and practice. We also highlighted the shortcomings of the study and suggested areas for future research.

2. Theoretical Framework and Model Development

We constructed the research model (**Figure 1**) by reviewing the attribution theory literature and the digital divide literature. We can study the relationship between the use of social media by disaster-prone communities for disaster management and their intention to adopt social media using literature on the "digital divide". Although disaster-prone communities include populations with disabilities, weak socioeconomic backgrounds, elderly people, and marginalized communities [20] [21], for the purpose of this study, we examined disaster-prone communities through the lens of a deprived group, specifically Sierra Leoneans in disaster-prone communities. People who live in disaster-prone areas are more susceptible to disasters, according to previous studies [8] [10] [22]. Similar studies have indicated that underprivileged communities are more affected by disasters than other demographics [1] [13]. The goal of this study was to comprehend how disaster-prone populations, in this example villages in Sierra Leone, use social media for disaster management.

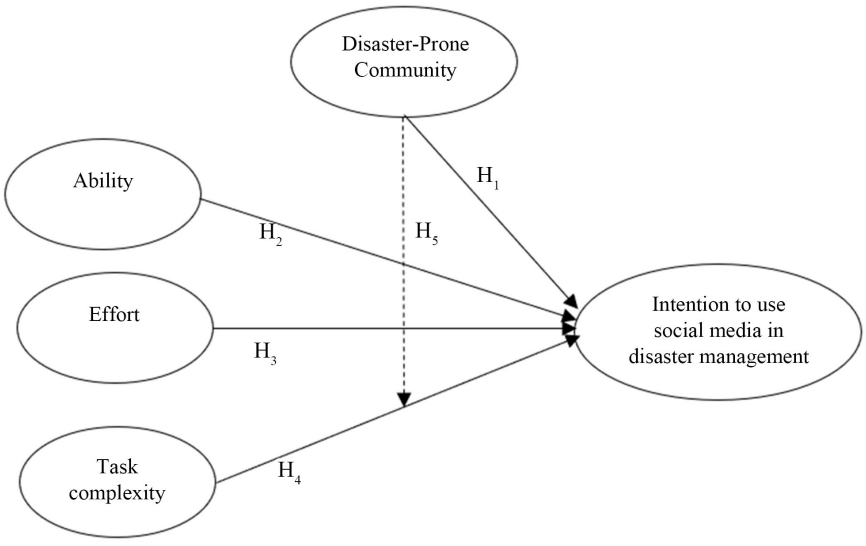

Figure 1. Research model.

Although there are competing theories that can provide light on the use of technology, such as the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT), their primary focus is the application of technology. Given the pervasiveness of social media, the usage of social media itself may not be as concerning as the actions that lead people to use social media for disaster management. In this study, we looked at how some communities in Sierra Leone that are prone to disasters use certain information and communication technologies (social media) to deal with an unanticipated and unwelcome event (a disaster).

Disasters mostly have two unfavorable and unexpected qualities. Understanding how people act when presented with an unforeseen, unwanted consequence is the foundation of attribution theory [23]. There are three phases of attribution: the first stage occurs when someone notices a particular behavior; the second stage occurs when the observer assumes that the behavior was deliberate; and the third step occurs when the behavior is attributed to either the person or the circumstance [24]. Using this comparison, we looked at the action as the reduction of catastrophe risks and the circumstance as the use of social media for disaster management. So, a community vulnerable to disasters might be persuaded to adopt social media for disaster management if it is credited with helping to reduce the risks of disasters. As a result, looking at how a community that is vulnerable to disasters uses social media for disaster management through the lens of attribution theory gives us insights into the behavior that encourages people in that community to use social media for disaster management as well as what else may serve to further encourage that behavior. In light of this, we decided to apply attribution theory to analyze the intention to use social media.

2.1. The Digital Divide

According to [25] [26], the term "digital divide" describes the separation between people who have access to information and communication technology (ICT) and people who do not. The term "digital divide" was first used in the 1990s by scholars to describe the disparity between those who have access to computers and the Internet and those who do not [11]. Earlier studies on the digital divide concentrated on the infrastructure needed to use computers and the Internet, as well as on their accessibility and affordability [21] [27]. Later studies in this field focused on evaluating the development of the ICT market and sector, ICT penetration and household usage, ICT usage by businesses and government, and the evolution of ICT education in order to explore the digital divide [25] [26]. Other studies [5] [8] used the digital divide to understand the demographic, economic, and social characteristics of ICT users and to understand the socioeconomic differences regarding the use of ICT.

We expanded on this idea of the digital divide to comprehend how social media, which is quickly becoming a popular ICT for disaster management [28] [29], is used. Previous research has shown that different social groups participate in social media usage differently after catastrophes [3] [10] [29]. When compared

to populations that are vulnerable to disasters, those who have had a good education in the arts, commerce, management, and sciences are more likely to use social media. There have been reports that populations at risk of disaster suffer disproportionately more during natural disasters than other communities. Social media's ability to permeate society means that having access to it may not be as problematic as using it effectively to manage crises. The focus of the digital divide has recently switched to technology usage rather than accessibility or affordability as ICT has become more pervasive [20] [21]. Consequently, using social media for a particular goal, like disaster management, may involve a wide range of skills, including the ability to sort through and navigate through a lot of information, identify useful information, and take appropriate action on this information. Recognizing a problem's existence is the first step toward finding a solution. People in disaster-prone areas can therefore lack the necessary abilities to use social media to manage disasters rather than having access to it. So, we proposed the following hypothesis:

H_1: *The digital divide influences the use of social media for disaster management such that there exists a negative relationship between disaster-prone communities and their use of social media for disaster management.*

2.2. Attribution Theory

According to [30], attribution is a psychological variable that looks at the cognitive process through which a person infers the motivation behind another person's conduct. According to [30], research on the attribution theory mainly focuses on how people perceive causality, or what causes conduct. This view of the reason for behavior also influences how people respond to that behavior. Other studies have expanded on this notion by connecting causes to outcomes and circumstances that an individual encounters rather than only focusing on how people behave [31] [32]. One of the fundamental goals of the attributional process is to predict and control events and outcomes by comprehending, organizing, and constructing meaningful viewpoints. This propensity to try to influence outcomes is especially pronounced in the case of unforeseen events like disasters [33].

Examining communication techniques for product harm crises was one of the earliest research to apply attribution theory to evaluate communication behavior [34]. Another study by [35] used attribution theory to investigate the various approaches taken by organizations to deal with various crises. Similarly to this, [36] employed attribution theory to clarify why people reacted the way they did to a group responsible for an oil spill accident. In order to establish a paradigm that explains the lack of communication during the preparation and mitigation phase of disaster management, [32] turned to attribution theory. These findings suggested that attribution theory might serve as a useful lens for comprehending disaster management given the unfavorable and unpredictable character of disasters. Research that can offer a thorough framework for comprehending communication and information exchange through social media during catastrophes

is still lacking, nevertheless.

In this study, we used the Weiner model of achievement attributions to analyze how disaster-prone populations use social media to manage disasters. According to this model's three causal characteristics of locus, stability, and controllability [20] [21], the attributional components are categorized. In terms of location, whether internal or external to an individual, the dimension of locus investigates the attributional aspects. As a result, the individual may place the blame for his or her success or failure in using social media for crisis management on internal or external sources.

The stability dimension categorizes the attributional elements as either constant, suggesting that the causes are stable and long-lasting, or fluctuating over time, showing that the causes are unstable and subject to change. As a result, the person can assess if the causes of the effective use of social media in disaster management are stable or unstable. If the person believes that the factors that led to successful use are constant, then the result can be simply repeated in many situations and circumstances. The person may, however, be disposed to believe that the successful use of social media for disaster management was a one-time success if they perceive the reason to be unstable, meaning that it changes over time, and they may not be disposed to use social media for disaster management in the future because the results might not be trustworthy.

The dimension of controllability, which [32] examined, looks at the individual's ability to influence the attributional components. As a result, the person has some control over how they utilize social media. He or she won't, however, be able to influence how the disaster is handled. Based on these three characteristics, we investigated how ability, effort, and task complexity affect how disaster-prone populations use social media for disaster management in this study.

"Ability" in this study refers to a person's capacity to use a certain technology for a particular purpose. Ability was rated as highly stable and internal by [8]. As a result, the ability is the sense that an individual has of how good they are, and this view is constant across time. It's possible that people don't have a lot of control over how they perceive their abilities [22]. Given the accessibility of mobile devices for accessing social media and the pervasiveness of social media [10], all populations, especially disaster-prone communities, should have a positive opinion of their capacity to use social media. Therefore, people will be more likely to use social media for disaster management if they believe they have a clear understanding of how it works. Similarly to this, people will be more motivated to use social media for crisis management if they believe that doing so is something that comes naturally to them. People will be more inclined to use social media for disaster management if they have a positive opinion of their capacity to do so. So, we proposed the following hypothesis:

H_2: *There is a positive relationship between attributions of ability and the intention to use social media for disaster management.*

In this study, "effort" was defined as the time and resources that an individual is willing to commit to learning how to use social media to manage disasters.

According to [8], effort is a volatile and controllable internal attribution. As a result, it is up to each individual how much time and money they want to devote to learning how to use a particular technology effectively for a particular goal. The effort that people expend when using technology can also differ. Social media's widespread use guarantees that people from various communities can access these platforms [10]. Therefore, if someone puts in the effort to master the various intricacies of using social media for disaster management, he or she may be more likely to use social media for disaster management. So, we proposed the following hypothesis:

H_3: *There is a positive relationship between attributions of effort and the intention to use social media for disaster management*.

The degree of difficulty an individual encounters when completing the assigned tasks is what we referred to as "task complexity". Task complexity was categorized as a stable external attribution by [26]. The degree of difficulty of some jobs may be predetermined, and the person performing the activity may not have any control over it [26]. Therefore, if utilizing social media to manage catastrophes is not regarded as being simple, then the person is unlikely to utilize social media to manage disasters. Similar to the previous example, a person's propensity to use social media for disaster management decreases if they believe they frequently make mistakes when doing so. The likelihood that people will utilize social media to handle disasters decreases if they believe that entering data or getting information will be challenging. In other words, if the task complexity of using social media for disaster management increases, so does the intention to use it. So, we proposed the following hypothesis:

H_4: *There is a negative relationship between attributions of task complexity and the intention to use social media for disaster management*.

The moderating effect of living in a disaster-prone area on the connection between job complexity and the intention to use social media for disaster management was also explored. Task complexity has an external attribution, in contrast to effort and aptitude [5]. Thus, an activity that one person might find challenging may appear straightforward to another. Prior research has demonstrated that there is a gap between various socioeconomic categories when it comes to the completion of particular online tasks or the time required to accomplish them [27]. Online tasks may be viewed as challenging by marginalized areas due to the varying levels of digital literacy when it comes to using the Internet [3] [9]. Individuals from communities at risk for catastrophe may think that similar duties are harder, and this extends to the use of social media for disaster management. Therefore, task complexity will have a more detrimental impact on communities that are vulnerable to disasters. So, we proposed the following theories:

H_5: *Being part of a disaster-prone community will moderate the relationship between task complexity and intention to use social media for disaster management such that the relationship will be stronger for disaster-prone communities*.

3. Methodology

In this study, we employed a structural equation modeling (SEM) strategy and survey methodology. Items for evaluating ability (A), effort (E), and task complexity (TC) components were modified from [37] original versions to fit the needs of our study. The survey instruments used to measure "intention to use (IU) social media (SM) for disaster management" were contextualized to fit our study and were modified from the TAM literature. The survey questions were modified from previously vetted survey instruments and placed in the appropriate context for our investigation. For these survey items, we ran validity and reliability testing. Section 4 contains more information on the tests and their outcomes. The survey items were scored using a five-point Likert scale, with 1 denoting "strongly disagree" and 5 denoting "strongly agree", to use convenience sampling to collect the data for this investigation.

4. Analysis of the Results

In August 2022, 300 persons in Freetown, Sierra Leone's disaster-prone communities received the survey. Out of the 300 survey participants, 216 responded to the survey, filled it out, and sent it back. About 72% of respondents responded. 45.7% of the 216 participants who completed the poll were men, and 54.3% were women. Most respondents (64.7%) had completed high school or had some college education, and 58.9% earned less than Le 6,000,000 annually. Most of the responders (74%) were renters. Only 11.2% of the respondents reported being homeowners, and the remaining 14.4% remained silent. This suggests that low-income individuals make up the bulk of the population in these disaster-prone areas. In general, 74% of respondents were between the ages of 18 and 34, 22% were between the ages of 35 and 55, and 4% were over the age of 55.

To validate the model, we employed the SEM technique. According to [38], the SEM method is a data analytic approach for assessing theoretical links between systems of variables. SEM has been widely employed in studies across a variety of social science domains to analyze data.

The measurement model and the structural model are the two models the SEM method offers evaluation for. The link between the measured variables and their latent variables or theoretical constructs is described by the measurement model. This is accomplished by assessing the validity and reliability of the measures. The structural model looks at how the theoretical constructs relate to one another [39].

4.1. Analysis of the Measurement Model

By analyzing the factor loadings and the average variance extracted (AVE), we assessed the convergent validity of the constructs. The factor loadings look at how well the linked construct is described by the observed variable [40]. The survey items in the survey questionnaire are the observed variables. For instance, in **Table 1**, AB1, AB2, and AB3 stand for the three survey items used to measure the construct "ability", EF1, EF2, and EF3 for the construct "effort", TC1, TC2,

TC3, and TC4 for the construct "task complexity", and IS1, IS2, IS3, and IS4 for the survey questions used to measure "intention to use social media". All retained items had loadings that exceeded the suggested 0.7 thresholds (**Figure 2**) and were significant at the 0.01 level (see **Table 1**). An AVE score of 0.5 or better is required for a model to be considered adequate [39] [41]. All the AVE values of the constructs were higher than the suggested cutoff point of 0.5 (see **Table 1**), indicating that our constructs have sufficient construct validity.

Table 1. Reliability and validity of measurement model.

Construct	Items	Loadings	CR	Cronbach's Alpha	AVE
Intention to use social media	IS1	0.874	0.907	0.834	0.782
	IS2	0.793			
	IS3	0.824			
Ability	AB1	0.703	0.931	0.836	0.723
	AB2	0.802			
	AB3	0.904			
Effort	EF1	0.894	0.901	0.837	0.719
	EF2	0.803			
	EF3	0.904			
Task complexity	TC1	0.834	0.887	0.821	0.704
	TC3	0.902			
	TC3	0.893			
	TC4	0.884			

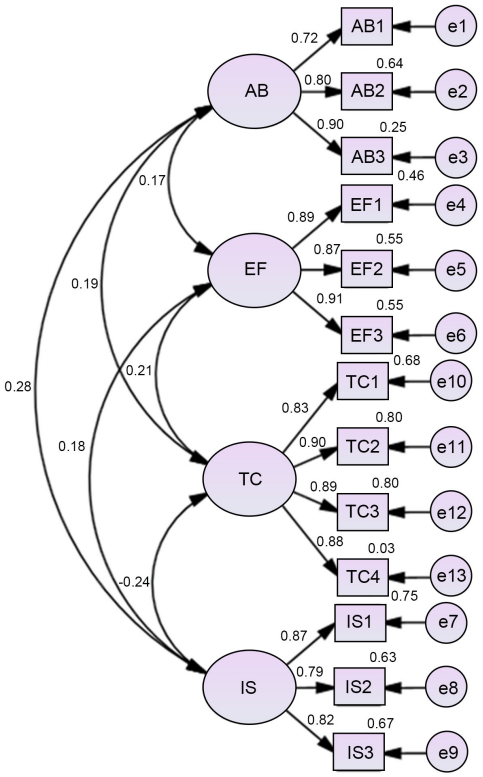

Figure 2. Latent construct for the measurement model.

4.2. Analysis of the Structural Mode

The links between the variables in the model are investigated via the structural model. By employing 5000 subsamples and the bias-corrected, accelerated bootstrapping method with replacement, we assessed the structural model. A one-tailed t-test for unidirectional hypotheses through AMOS was used to evaluate the hypotheses [42].

The study's findings, which support the digital divide and intention to use social media hypothesis (H_1), show a negative link between disaster-prone communities and intention to use social media for disaster management ($\beta = -0.147$, $p < 0.01$). The effort and intention to use social media hypothesis (H_3) is supported by the finding that there is a positive association between effort and intention to utilize social media for disaster management ($\beta = 0.583$, $p < 0.01$). The task difficulty and intention to use social media hypothesis (H_4) is supported by the finding that there is a negative connection between task difficulty and intention to utilize social media for disaster management ($\beta = -0.170$, $p < 0.01$). The moderating role of the disaster-prone community on the relationship between task difficulty and intention to use social media hypothesis (H_5) is supported, albeit in the opposite direction (**Figure 3**), by the positive relationship between the disaster-prone community and task difficulty and intention to use social media for disaster management. However, the association between the ability and intention to use social media for disaster management was not supported. **Figure 3** and **Table 2** present the findings of our test. Overall, the estimated model explains about 43% ($R^2 = 0.43$) of the variance in the "intention to use social media for disaster management."

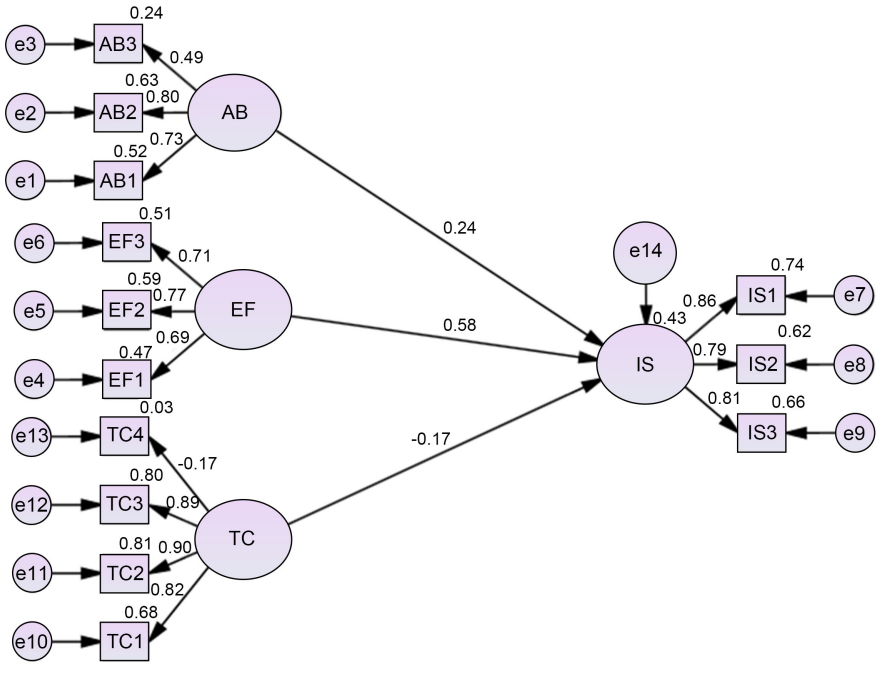

Figure 3. Structural model.

Table 2. Path coefficients of the SEM.

Variable	Path	Variable	Estimate	S.E.	C.R.	*p*
AB	→	IS	0.241	0.174	−1.385	0.076
EF	→	IS	0.583	0.047	15.250	***
TC	→	IS	−0.170	0.027	−5.977	***
DPC	→	IS	−0.147	0.042	−5.676	***

Finally, the high-low analysis of the moderating effects of disaster-prone communities is shown in **Figure 4**. The slope interaction test was utilized to examine the moderating effect. **Figure 4** shows the interaction of disaster-prone communities on the relationship between task complexity and intention to use social media for disaster management. The lines on the graph show that being part of a disaster-prone community, the moderating effect will be higher, and the intention to use social media for disaster management will be increased by the disaster-prone community. Thus, Hypothesis 5 is supported.

5. Discussion of the Results

This study looked at the propensity of disaster-prone communities to use media and elements that may affect how social media is used for disaster management. The findings show that disaster-prone communities have a low inclination to use social media for disaster management. This concurs with earlier studies on the digital divide. The accessibility and affordability of technology for disaster-prone communities are significantly lower than that for other better-served communities, according to earlier studies that looked at the digital divide [3] [10]. The findings of this study are consistent with those of earlier research about the usage of technology. Thus, social media platforms may be freely accessible to everyone in the current digital era due to their pervasiveness. For underprivileged communities, it may still be difficult to use these tools for the betterment of people's circumstances, such as using social media to obtain pertinent information about disasters so that people can take preventative action.

The study's findings also show that an individual's effort and their intention to use social media for disaster management are positively correlated, whereas the task complexity and their intention to use social media for disaster management are negatively correlated. These findings are by those of earlier research [33], which viewed performance through the prism of attribution theory and found that increased effort leads to improved performance and increased task complexity leads to a fall in performance. Our findings are in line with earlier research employing the attribution theory to study the use of information systems in general. According to earlier research, task difficulty has a negative association with computer self-efficacy, although individual competence and effort are positively connected to computer self-efficacy [22]. As a result, the study's findings suggest that the attribution theory applies to social media's role in crisis

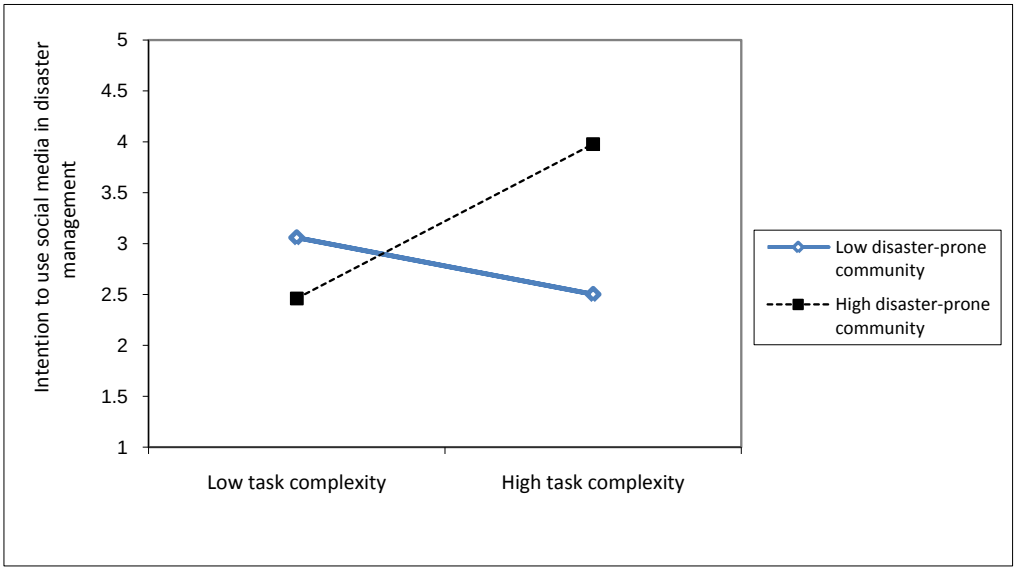

Figure 4. Moderating role of disaster-prone community.

management. People are more likely to use social media for disaster management when they make a greater effort to understand how to use it. Similarly to this, people become less motivated to use social media for disaster management if they think using it will be complex. Surprisingly, we did not discover evidence to support the hypothesis that the ability to use social media for disaster management is correlated to do so. Given the widespread usage of social media, it is likely that the respondents to our study were quite familiar with its use and thought they were highly adept at utilizing it. Therefore, it might not be crucial for them whether they can use social media for disaster management.

According to the study's findings, there is also a mitigating effect of belonging to a disaster-prone community on the relationship between task complexity and the intention to use social media for disaster management. Intriguingly, the moderating impact's direction is the exact opposite of what our model predicted.

When we looked more closely, we discovered that the intention to use social media is low for members of the disaster-prone community in our case study at lower levels of task complexity; however, as the perception of the task complexity increases, the intention to use social media also increases (**Figure 4**). This sounds contradictory, especially given that earlier research [6] [7] revealed that the tendency to utilize a particular technology decreases as the difficulty level increases. People may think the tasks are too simple for them to justify the usage of social media, which is one of the likely explanations for low motivation for completing low-complexity tasks utilizing social media. The fact that individuals in disaster-prone communities have been victims and have suffered unfairly during disasters is a likely explanation for an increase in incentive to use social media for disaster management [16]. They would want to use the communication tool to keep themselves safe once they are aware that it exists and can assist them in protecting themselves from disasters and damage.

6. Conclusion and Recommendations

There are several important practical values from this work. First, this study's findings suggest that just because you have access to or can afford technology, it doesn't necessarily follow that it's being used wisely. Therefore, the underserved people in a community should be informed of how to utilize social media for getting such information. Government agencies and groups entrusted with spreading information through social media for preventing disaster-related casualties should make this sure.

Second, the study's findings suggest that people are more likely to use social media for crisis management with higher effort and less challenging tasks. In order to encourage underprivileged areas to use social media for disaster management, disaster management organizations should provide guidelines on how to do so in a way that makes the activities necessary to do so simply. The findings also show that while populations at risk for catastrophe may view the task of using social media for disaster management as challenging, they prefer to use these platforms for communication and information sharing during disasters. Governmental organizations and disaster management agencies should encourage residents of communities at risk for disaster to use social media for disaster management by providing them with the knowledge and skills to do so.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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