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Harnessing ICT Resources to Enhance Community Disaster Resilience: A Case Study of Employing Social Media to Zhengzhou 7.20 Rainstorm, China

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Abstract: This study aimed to explore how community disaster resilience can be enhanced via the utilization of ICT resources. Three social media applications were selected. Taking the 2021 Zhengzhou 7.20 rainstorm as an example, questionnaire responses were collected and analyzed, and a linear regression model was constructed to explore the impact of the relationships between responses. The findings showed that the use of WeChat, TikTok, and Weibo had positive effects on community disaster resilience. Specifically, the use of social media (WeChat, TikTok, and Weibo) by the general public during this rainstorm disaster was positively related to convenience and trust, creation and dissemination, emotion and communication, cooperation and collective action, and relief and release. We also analyzed the differences in the use of the three social media platforms during the rainstorm disaster and found that the number of people who used TikTok was the highest, but the variable scores for TikTok were not the highest. WeChat had the highest variable scores, and both the number of users and variable scores for Weibo were in the middle.

Keywords: information and communication technology (ICT) resources; heavy rainstorm; flood; social media; community disaster resilience

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1. Introduction

Intense and widespread natural disasters are increasing at an unprecedented rate. Climate change driven by human behavior is accelerating the occurrence of natural disasters and exacerbating the risk of extreme weather disasters. As climate change and natural disasters intensify, these extreme challenges may occur in areas where they have never been encountered before [1]. Natural disasters can happen anywhere in the world, but their effects depend on how vulnerable human communities are to these catastrophes and how severe the natural phenomena are [2]. Natural disasters tend to be more devastating in developing countries due to economic, political, social, and cultural factors that increase vulnerability [3]. Henan Province in China experienced an excessively strong rainstorm from 17 July to 23 July 2021, which triggered severe flooding. According to the "Investigation Report of the '7 20' Extraordinary Rainstorm Disaster in Zhengzhou, Henan Province," the 7.20 rainstorm was a natural disaster that resulted in significant property damage and casualties, severe flooding in cities and rivers, and numerous other disasters, including building collapses, landslides, and subway accidents [4]. Verified sources have claimed that 14,786,000 individuals were impacted, and as of 30 September, there had been direct economic damage of 120.6 billion RMB. Three hundred and ninety-eight people perished or went missing as a result of the tragedy [5]. The local government and grassroots district governments, counties, departments, and units displayed a serious lack of risk awareness

and preparedness, and there were instances of negligence and malfeasance during the emergency response that resulted in casualties and irreparable losses.

Previous scholars focused on exploring methods of assessing disaster risk have discussed and applied methods of risk assessment for natural disasters as well as methods to enhance disaster resilience, such as pairwise comparisons using the analytic hierarchy process (AHP) and analytical measurements using the WLC method, which identifies criteria and elements that can be used to reduce the vulnerability of a community and to promote disaster risk reduction [6]. Lyu et al. have conducted many integration studies [7,8], and in their latest study integrated the Grey-DEMATEL into the AHP (referred to as G-DEMATEL-AHP) to identify the most hazardous locations at risk should a disaster occur and assessed the risk of a flood disaster by calculating the weights [9]. The National Research Council [10] explored SNA and its application to the identification, design, development, and implementation of population-specific social networks, and the strengthening of community resilience to natural and manmade disasters. Varda et al. proposed a framework for describing social networks in disaster settings, generally arguing that the social network analysis approach is useful for developing a more comprehensive understanding of who is at risk, who is recovering, and how survivors are recovering from a disaster [11]. The first attempt to utilize social network analysis (SNA) methods to measure community resilience was carried out from the perspective of stakeholder social capital [12].

Information and communication technology has advanced quickly in recent years, especially in terms of its application in disaster management. Studies have examined the use of ICT in the coordination of emergency relief efforts [13], the provision of ICT-enabled administrative services for citizens [14], access to health-related information and emergency services [15], how the use of mobile devices and the internet can help excluded populations integrate into society [16], behaviors related to reaching out to diverse family and friends for emotional support during crises and disasters [17,18], and information sharing [19]. There is growing evidence that ICT is utilized to close communication gaps [20,21]. In particular, the use of social media and its analysis has yielded benefits in the field of disaster management [22–24]. ICT has developed into a vital tool for governments and organizations in the context of the widespread occurrence of disasters, as it allows these entities to provide information and organize resources for disaster management in order to lessen the devastating consequences of disasters [25]. The media—and the public—have rejected the old, top-down information model. Today, communication occurs from person to person, and all individuals are news producers and consumers [26]. In particular, in the case of this study, local communities and citizens use their own resources, especially social media platforms, to carry out self-help and mutual aid tasks and communicate relevant disaster information, help-seeking information, etc., when a crisis occurs. The role of ICT in enabling the coordination of aid delivery and assistance during disasters has become an active research topic.

Although much of the current research focuses on the use of ICT during disaster recovery in developed countries, previous research has focused more on the use of social media to analyze citizens' ability to cope during disasters using social media platforms such as Facebook and Twitter. ICT's role during disasters in underdeveloped countries is one that has not received much attention. There are few studies based on social media platforms in developing countries that consider sudden-onset natural disaster events as a context, and the studies that do exist suffer from a lack of event-specific case studies and empirical data analysis. At the same time, these studies seem to ignore the impact of the use of various social media tools on disaster resilience in developing countries and the differences between people's choices and plans. This study aimed to close this gap. In the future, it will be necessary to conduct more thorough and specific research on how the use of ICT resources, specifically social media, can impact and improve the resilience of people living in developing countries during disasters.

This rainstorm-related flooding incident received extensive media attention and offers a complex, challenging case study that can be used to examine the most effective ways for

social media platforms to be used to respond to and manage urban storm flooding. At the same time, this event offers important lessons for other cities and regions aiming to prevent such a tragedy from happening. This study explored ICT use cases and aimed to investigate the ways in which social media can be utilized to enhance or supplement the resilience of communities and to reduce the risk of disasters. Specifically, it examined how citizens in Zhengzhou used social media to enhance their disaster resilience during the 7.20 rainstorm, highlighting the importance of active citizen participation in disaster management as well as community-level measures to increase resilience to natural disasters.

2. Theoretical Background

2.1. ICT Resources and Disaster Resilience

Disasters are sometimes confused with crises, but crises are typically organization-based, whereas disasters affect the community as a whole [27]. Given the emergent and complex nature of disasters, the mitigation of their impact is critical [28]. During disasters, more and more individuals are turning to new technologies to acquire accurate, trustworthy, and timely information. Information and communication technologies (ICTs) have become an effective tool in promoting disaster response [29]. As stated by Tamilselvan et al. [30], ICT (information and communication technology) is a term that is often used interchangeably with information technology (IT), but it is a broader concept that highlights the importance of unified communications in addition to telecommunications (such as telephone lines and wireless signals): computers, middleware integration, storage, and audiovisual systems that allow users to create, access, store, transmit, and manipulate information. The use of ICT resources has been shown to be an effective method of disseminating information in disaster response scenarios [31]. ICT resources provide real-time communications for life-saving applications such as search and rescue actions, confirming the safety and security of family, friends, and assets, and providing disaster recovery services [32]. ICT resources use aids in information generation and support better decision making for effective disaster management systems, and ICT resources are considered necessary to enhance adaptive capacity and support feedback, ensure access to information, promote active participation, and reduce vulnerability [33].

Today, ICT resources are utilized across various fields to ease and facilitate multiple aspects of human life. Existing ICT resources are already being used by the public, private, and civil sectors, where they offer the potential to reach a wide range of people, especially through mobile devices that allow unrestricted access to the internet from anywhere. ICT resources have advanced significantly and can make use of a variety of technologies to produce information during disasters. In addition to this, significant improvements in computing power have enabled the management and analysis of large datasets during disasters [34]. Specifically, the rapid development of artificial intelligence, smart cities, social media, etc., has enabled researchers to collect and analyze detailed information, and the new generation of communication technologies provides high-speed voice, image, and data transmission, which was previously unimaginable [35–37].

The value of a technology lies in its application rather than in the technology itself, which could clarify why ICT resources that previously had no significant role in an organization may become the fundamental component of its technology infrastructure after a crisis. In practice, technology "focuses on emerging technological structures formulated in practice rather than specific structures fixed in technology" [38]. Thus, people create and reconfigure their communication and technology systems in response to the environmental changes brought about by disasters in order to access the connections and resources required for recovery [19,39]. Researchers are increasingly focusing on studying the role of ICT resources in disasters and disaster response [40–42]. In particular, the increased usage of social media made possible by ICT has contributed to disaster resilience and management [31].

2.2. Social Media and Community Disaster Resilience

Similarly to the mass media, social media has made it possible to easily disseminate enormous amounts of information to vast audiences. Recent years have seen a considerable rise in the use of social media in post-disaster environments, and popular services like Twitter and Facebook are now being used to meet various disaster data-gathering demands [43]. Social media offers value in terms of information sharing through web-based platforms and services that can be accessible through information and communication technologies such as desktop computers, laptops, cell phones, and tablets [44]. "Social media" and "resilience" are two terms that now appear frequently in the emergency and disaster management literature [45]. The popular use of social media in disasters has increased its potential as a new source of data for understanding disaster resilience [46]. Several studies have attempted to investigate social media activity during disasters. For example, one study found that people posted situation updates and losses on social media platforms during disasters [47]. Katz and Rice [48] found that during a crisis, people used various social media platforms to develop temporary solutions in order to stay connected to their networks. Social media enables users to share, publish, manage, collaborate, and interact with members of the public in virtual communities at the click of a button [49]. In general, social media has been described as facilitating an online community containing up-to-date crisis information in which members seek and share information and guidance in unfamiliar situations during times of crisis [50]. Some important big-data technologies, such as social media data, are frequently used in different stages of disaster management and to enhance disaster resilience [51]. Social media has enabled citizens to provide valuable help to those professional organizations affected without having to expend a great deal of time and energy.

Currently, there are over 75 social media platforms, with the most popular ones being Facebook, YouTube, WhatsApp, Messenger, WeChat, Instagram, TikTok, Tencent QQ, QZone, and Sina Weibo, according to the number of users [52]. Social media platforms such as Facebook, Twitter, and TikTok have become important disaster response technologies in recent years due to their instant connectivity and open platforms, which allow the dissemination of real-time information [53,54]. Social media preferences vary from country to country: the Chinese prefer WeChat, and Brazilians and Indians prefer Orkut, in contrast to Facebook and Twitter [31].

Studies have demonstrated that social media fosters collective intelligence, which involves large and distributed groups of individuals working together to solve intricate problems. People in a community will step up to assist those who are in danger or distress [55]. Social media enhances resilience by enlarging the community of impacted people, i.e., those who cooperate to solve problems, exchange information about the situation, offer assistance, and otherwise respond to the situation [56]. Earle and others explored Twitter's role in reporting earthquakes and assessing their impact, and their results suggest that Twitter activity can help to identify affected areas more quickly than traditional monitoring methods [57]. Using Hurricane Florence as a case study, Yuan et al. [58] explored the use of social media to analyze the ways in which citizens with different demographic characteristics exhibit different responses and behaviors during the same disaster. During disasters, social media is used for C2C communication. For example, Typhon Meranti in Xiamen, China showed that during catastrophic disasters, people depend on credible information from the government, even if they access it through official government sources on social media [59]. Social media platforms are important for creating the situational awareness needed to coordinate actions among affected communities during natural disasters [60]. Previous studies have focused on the use of social media to analyze citizens' capacity to cope during disasters, and have focused on social media platforms such as Facebook and Twitter. However, these studies seem to have ignored the impact of other social media platforms' use on disaster resilience in developing countries and the differences in people's choices and preferences for social media platforms. In the present

study, we analyzed the use of different ICT-based social media tools to enhance community disaster resilience.

3. Materials and Methods

3.1. Data Sources

This research applied a questionnaire to collect relevant data on each index variable. The questionnaire was divided into two parts: a basic personal information section and the main part of the questionnaire. In the first part of the questionnaire, identification questions were used to differentiate the respondents. The question "Have you experienced the "7.20" rainstorm in Zhengzhou?" was designed to identify the respondents who experienced the 7.20 rainstorm in Zhengzhou to ensure a valid sample. The first part of the questionnaire also included the question "What kind of social media software did you mainly use to obtain and release information about the "7.20" rainstorm?" The questions were categorized to prepare the main part of the questionnaire, which was related to the use of WeChat, TikTok, and Weibo. The main part of the questionnaire was designed to measure the corresponding indicator variables of convenience and trust, creation and dissemination, emotion and communication, cooperation and collective action, relief and release, and usage behavior and willingness. The questionnaire was administered using a uniform Likert scale (1–5), and respondents were asked to select "strongly disagree", "disagree", "undecided", "agree", or "strongly agree" after reading each question.

This study distributed the questionnaire as an online survey. The channels through which the questionnaires were distributed mainly included citizens living in Zhengzhou. The questionnaires were distributed via social media platforms such as WeChat groups, Moments, and QQ groups and through interpersonal relationships such as classmates and friends. Respondents directly opened the questionnaire link to fill in the questionnaire themselves. To enhance the breadth and diversity of participants, online questionnaires were distributed to individuals of varying age groups, both male and female, who filled out the questionnaire and then passed it to their acquaintances. After collecting the relevant data, we used SPSS 26 software to input and process the data, including reliability and validity tests, one-way ANOVA, *t*-tests, correlation analysis, and regression analysis, and obtain the final results. The specific steps and process are shown in Figure 1.

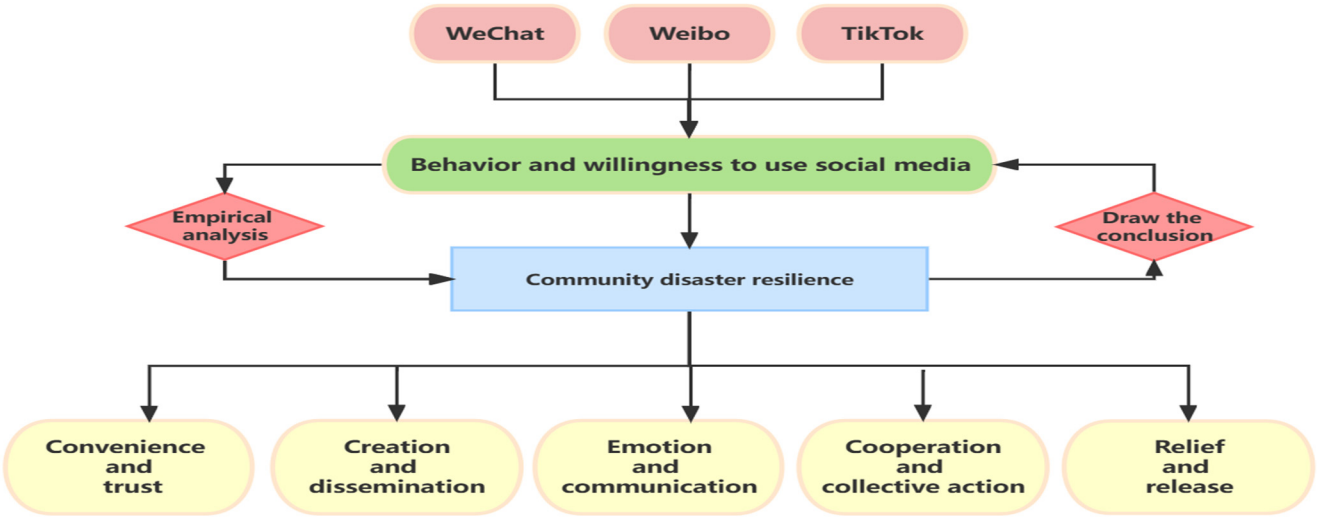

Figure 1. A model for using social media to influence community disaster resilience.

The largest questionnaire company in China (Wenjuan Xing) was commissioned to carry out the online distribution of the questionnaire survey used in this study. The questionnaire was distributed from 1 November to 5 November 2022, and 229 responses were collected. After eliminating invalid data, the final number of valid responses was 211.

Table 1 displays the basic demographic details of the 211 participants. Of the participants, 109 (51.66%) were male and 102 (48.34%) were female. In terms of age, 42 (19.9%) were under 20 years of age, 43 (20.4%) were 20–29 years of age, 47 (22.3%) were 30–39 years of age, 27 (12.8%) were 40–49 years of age, 37 (17.54%) were 50–59 years of age, and 15 (7.11%) were over 60 years of age. With reference to educational level, 31 people (14.7%) had completed junior high school education, 36 people (17.06%) had completed high school education, 52 people (24.4%) had completed a college education, 59 people (28%) had a bachelor's degree, and 33 people (15.64%) had a master's degree or above. In terms of occupation, students accounted for 22.75%, government and institution staff accounted for 8.53%, company employees accounted for 25.12%, self-employed people accounted for 19.43%, and other occupations accounted for 24.17%. Further, 53.6% of respondents had a monthly income of less than 5000 RMB, 21.3% earned 5000–10,000 RMB, 13.74% earned 10,000–15,000 RMB, 10% had a monthly income of 15,000–20,000 RMB, and 1.4% earned more than 20,000 RMB.

Table 1. Descriptive statistics of survey participants (N = 211).

Characteristics		Frequency	Percent (%)
Gender	Male	109	51.66
	Female	102	48.34
Age	<20	42	19.90
	20–29	43	20.40
	30–39	47	22.30
	40–49	27	12.80
	50–59	37	17.54
	<60	15	7.11
Education	Primary school	31	14.70
	High school	36	17.06
	College	52	24.64
	Four-year university	59	28.00
	Graduate school	33	15.64
Employment	Student	48	22.75
	Government and public institution staff	18	8.53
	Company employee	53	25.12
	Company owner or self-employed	41	19.43
	Other	51	24.17
Monthly income	<5000 RMB	113	53.60
	5000–10,000 RMB	45	21.30
	10,000–15,000 RMB	29	13.74
	15,000–20,000 RMB	21	10.00
	>20,000 RMB	3	1.40

Note: 1000 Chinese yuan (USD 1 = RMB 7.253).

3.2. Measurement of the Variables

In order to assess the questionnaire's reliability, a reliability analysis was performed. We chose Cronbach's coefficient for this purpose. In general, the stability of a dataset increases with the increase of the alpha value. According to the results of the reliability analysis (Table 2), it can be seen that the reliability coefficients of convenience and trust, creation and dissemination, emotion and communication, cooperation and collective action, relief and release, and usage behavior and willingness were 0.831, 0.858, 0.845, 0.851, 0.845, and 0.835, respectively. The reliability coefficient of the overall questionnaire was 0.968. The reliability coefficient has a range of 0 to 1, with a higher value indicating greater reliability. Therefore, the survey and its results were reliable.

Table 2. Concepts, measurement items, and reliability.

Concept	Items Measuring the Concept	Reliability
Convenience and trust	It is convenient to use (WeChat/Weibo/TikTok) to get disaster information. I can use (WeChat/Weibo/TikTok) to send help information. I can use (WeChat/Weibo/TikTok) to receive information about disaster response, recovery, and reconstruction.	0.831
Creation and dissemination	I can use (WeChat/Weibo/TikTok) to record and understand what happened. I can use (WeChat/Weibo/TikTok) to post or forward information about the disaster information. I can use (WeChat/Weibo/TikTok) to get relief supplies or help others to get relief supplies.	0.858
Emotion and communication	I can use (WeChat/Weibo/TikTok) to get emotional support and psychological comfort. I can use (WeChat/Weibo/TikTok) to express worry and sympathy for friends and relatives. I can use (WeChat/Weibo/TikTok) to help more people, which can make me feel happy, and thus get emotional satisfaction.	0.845
Cooperation and collective action	I can use (WeChat/Weibo/TikTok) to help people in need. I can use (WeChat/Weibo/TikTok) to win the appreciation and recognition of others. I can use (WeChat/Weibo/TikTok) to post relevant information to establish or maintain a social relationship with others.	0.851
Relief and release	I can use (WeChat/Weibo/TikTok) to listen to others or talk to others about the rainstorm. I can use (WeChat/Weibo/TikTok) to (re)post information, pictures, videos, etc. to relieve the fear and tension caused by rainstorm disasters. I can use (WeChat/Weibo/TikTok) to (re)send relevant information to commemorate the victims of the accident.	0.845
Behavior and willingness to use	Overall, I am satisfied with the experience of using (WeChat/Weibo/TikTok) to get disaster information. I will use (WeChat/Weibo/TikTok) to get disaster information when I face a disaster again. I would suggest my friends and relatives use (WeChat/Weibo/TikTok) to get or post-disaster information in case of disasters.	0.835

3.3. Data Analysis

First, descriptive analysis was used to analyze people's choice of social media in the event of the rainstorm disaster. Secondly, the overall score and satisfaction of people's choice to use social media was assessed, while specific differences in the use of each of the three social media platforms were analyzed separately. Finally, linear regression was used to explore whether the use of ICT had an impact on community disaster resilience, focusing on the relationships between the use of social media and convenience and trust, creation and dissemination, emotion and communication, cooperation and collective action, relief and release.

4. Results

4.1. Choice of Social Media Platform

According to the analysis results, in terms of social media choices when encountering heavy rainfall, the highest number of respondents (86) used TikTok to obtain disaster information, followed by WeChat and finally Weibo (Figure 2). Domestic internet applications in China have been growing significantly in recent years, with a steady growth across various social media services and news apps. Chinese citizens seldom access relevant information through traditional TV and news broadcasts, but more often use smartphones and computers to access and publish relevant information rapidly and in large volumes through social media platforms such as WeChat, Weibo, and TikTok.

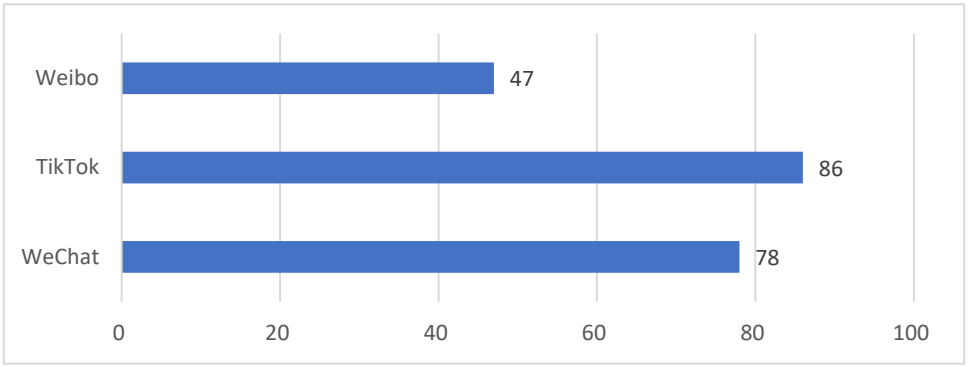

Figure 2. Choice of social media platform.

From the results, it appears that the largest number of users chose to use TikTok. Between these three social media options, the differences lie mainly in the fact that TikTok presents short videos with strong visual impact, representing an easy-to-understand and accessible way to communicate to people the events of the day. Compared with WeChat and Weibo, the more novel and interesting TikTok has objectively enriched the methods and means of releasing information and obtaining relevant disaster information. At the same time, some official TikTok accounts, such as that of the government, use the video release style of TikTok to present themselves differently from a previous serious image, showing their affinity with the public. In this way, government media is revitalized and fully integrates both voice and video, meaning that the public is more willing to engage with it.

4.2. Overall Satisfaction of People Using the Three Social Media Platforms

Figure 3 shows the overall satisfaction levels of people using the three social media platforms. The survey results showed that 39.7% of people reported the highest possible satisfaction when using WeChat (with a Likert scale score of 5), followed by 38.3% of people who were satisfied with using Weibo, and 32.6% of people who expressed satisfaction with using TikTok. Compared with TikTok, WeChat is mainly socially oriented, facilitating communication and contact between people beyond the limits of time and space and making communication between people convenient, fast, and free. At the same time, as the number of users has grown, WeChat has become more than just a communication tool: the Moments and WeChat official accounts accessed through the WeChat platform have become involved in every aspect of life. The group chat function of WeChat acts as a "meeting room," where there is a trend toward value homogeneity among different individuals based on one or more different connections and values. More than 10% of people reported the lowest possible satisfaction when using Weibo (10.6%), and people were less satisfied with Weibo compared to WeChat and TikTok in the context of the heavy rainstorm. In terms of communication content, Weibo is more like an open cultural square. Due to the openness and inclusiveness of Weibo, a non-homogeneous set of values is presented, and different values appear to collide during communication [61]. As an open

platform, Weibo features frequent negative comments and controversial statements. As a result, users may encounter offensive comments or arguments with different viewpoints, which may negatively impact their experience.

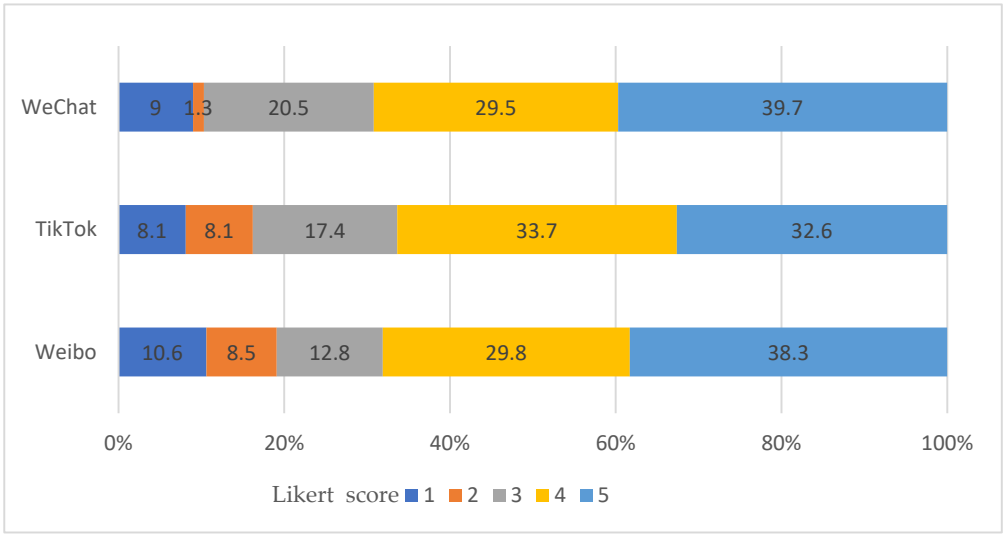

Figure 3. The overall satisfaction of people using the three social media platforms.

4.3. Social Media Scores for Each Variable

Figure 4 shows the scores for each variable, broken down by the three different social media platforms—WeChat, TikTok, and Weibo. WeChat scored the highest on each variable, followed by TikTok, and finally Weibo, which indicates that compared with Weibo and TikTok, the stronger interpersonal social relationship of WeChat produces a stronger interaction and intimacy between people. With higher similarity and relevance between groups, the frequency of interaction is also relatively high. Particularly considering the highly time-sensitive nature of information about sudden natural disasters, the information release behavior of WeChat users greatly affects the dissemination of relevant and important information, especially through the WeChat platform in the form of Moments, and the WeChat official account has become involved in all aspects of life.

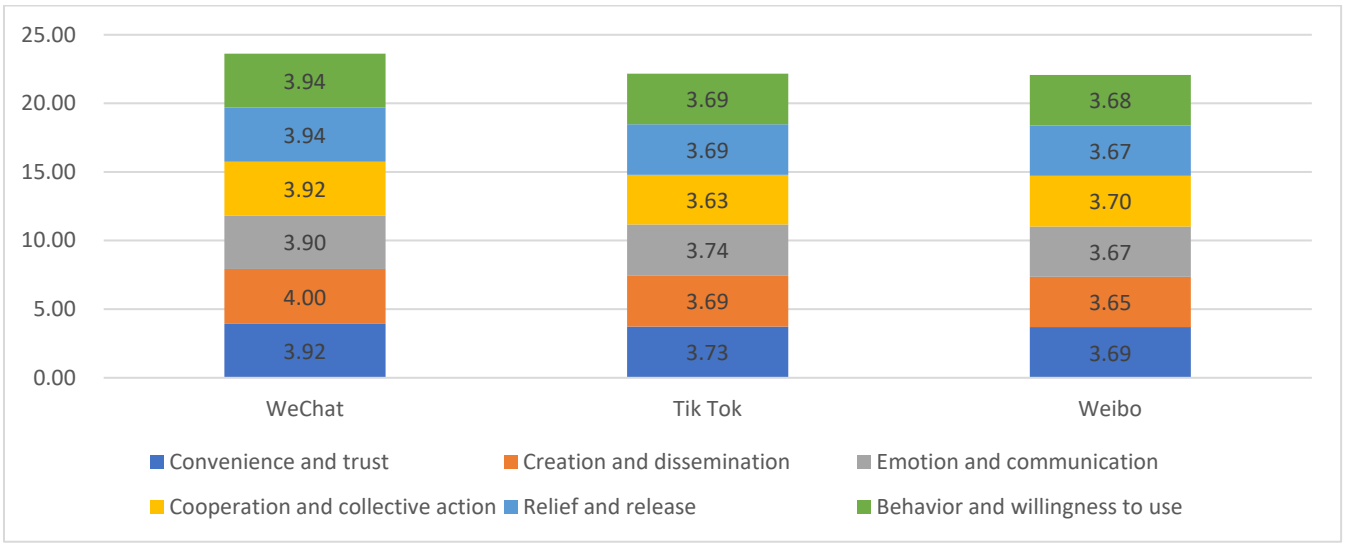

Figure 4. Social media platform scores for each variable.

4.4. Differences between WeChat, TikTok, and Weibo According to Sociodemographic Characteristics

In order to determine if there was a difference between the three types of social media in terms of sociodemographic characteristics, this study included a *t*-test and a one-way ANOVA.

Figure 5 shows the differences between WeChat, TikTok, and Weibo according to sociodemographic variables. We found that there were more women than men among the citizens who used WeChat, more men than women who used TikTok, and more women than men who used Weibo. In general, male citizens used TikTok more, and female citizens used WeChat more. Among the age categories, citizens under 20 and aged 20–29 and 50–59 used TikTok most often, citizens aged 30–39 used WeChat and TikTok most often, and citizens aged 40–49 and over 60 years old used TikTok most often. In the education category, people with a university education and those with master's degrees or higher used TikTok the most, while people with primary school and senior high school education favored WeChat. Further, citizens who worked for companies used WeChat the most, while students used TikTok the most. Finally, people earning less than 5000 RMB often used TikTok, and those earning 15,000–20,000 RMB and above often used WeChat.

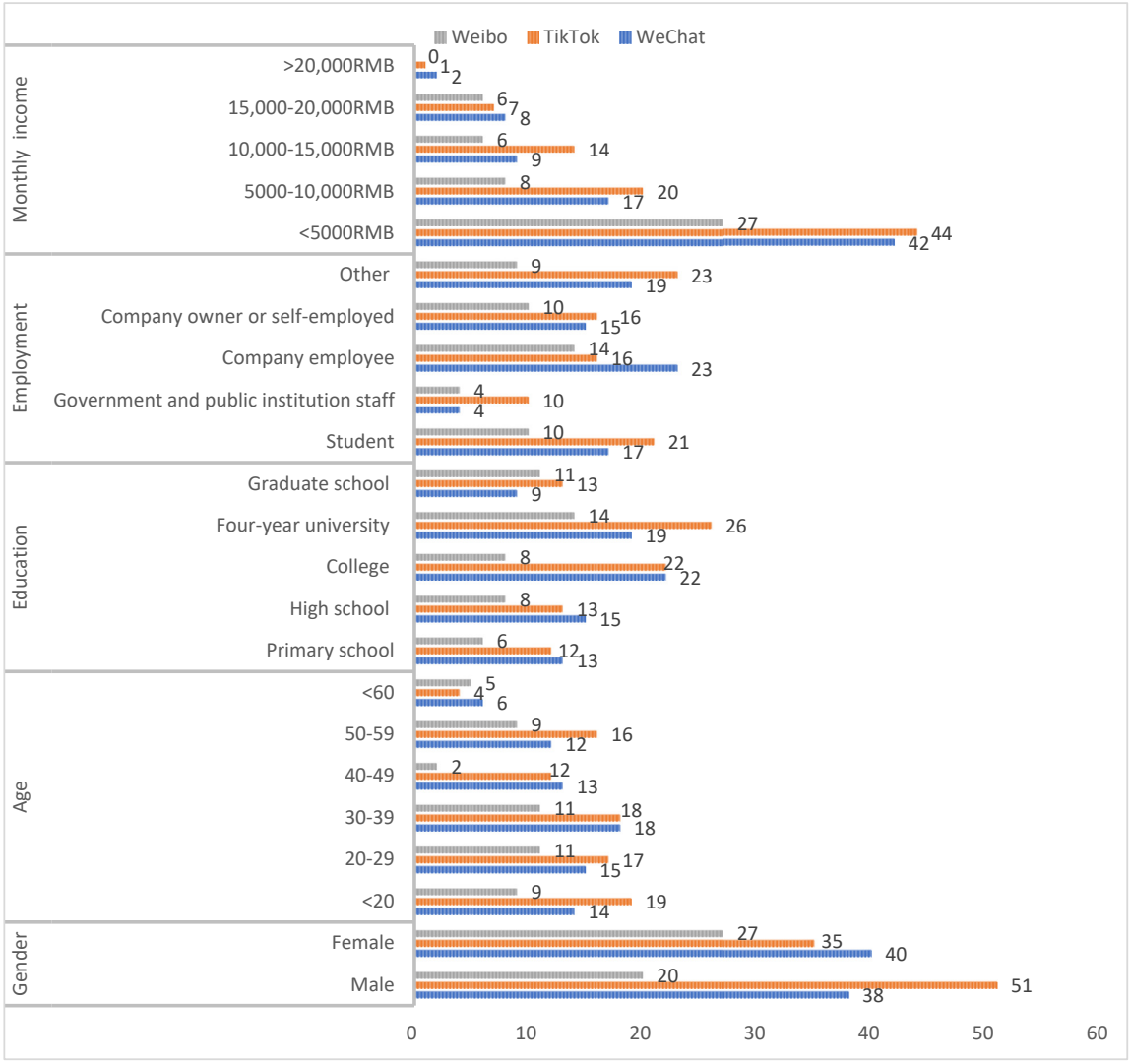

Figure 5. The differences between WeChat, TikTok, and Weibo according to sociodemographic variables.

4.5. Regression Analysis

In order to observe the relationships between the use of social media and community resilience, the data were analyzed using linear regression. The outcomes are displayed in Table 3. The results show that the use of WeChat had a positive effect on community resilience during rainstorms, particularly related to the variables of convenience and trust ($\beta = 0.819$, $p < 0.000$), creation and dissemination ($\beta = 0.815$, $p < 0.000$), emotion and communication ($\beta = 0.874$, $p < 0.000$), cooperation and collective action ($\beta = 0.883$, $p < 0.000$), and relief and release ($\beta = 0.790$, $p < 0.000$). Second, the use of TikTok also had a positive effect on community resilience during rainstorms, especially related to the variables of convenience and trust ($\beta = 0.939$, $p < 0.000$), creation and dissemination ($\beta = 0.935$, $p < 0.000$), emotion and communication ($\beta = 0.930$, $p < 0.000$), cooperation and collective action ($\beta = 0.936$, $p < 0.000$), and relief and release ($\beta = 0.949$, $p < 0.000$). The use of Weibo had a positive effect on community resilience during rainstorms, and the use of microblogs was particularly related to convenience and trust ($\beta = 0.703$, $p < 0.000$), creation and communication ($\beta = 0.718$, $p < 0.000$), emotion and communication ($\beta = 0.851$, $p < 0.000$), cooperation and collective action ($\beta = 0.856$, $p < 0.000$), and relief and release ($\beta = 0.756$, $p < 0.000$).

Table 3. Results of regression analysis.

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	R^2
Independent Variable	**Dependent Variable**	**B**	**Std. Error**	**Beta**			
Behavior and willingness to use WeChat	Convenience and trust	0.819	0.075	0.781	10.906	0.000	0.61
	Creation and dissemination	0.815	0.068	0.809	12.007	0.000	0.655
	Emotion and communication	0.874	0.072	0.813	12.160	0.000	0.661
	Cooperation and collective action	0.883	0.067	0.834	13.192	0.000	0.696
	Relief and release	0.790	0.070	0.791	11.262	0.000	0.625
Behavior and willingness to use Weibo	Convenience and trust	0.703	0.073	0.821	9.635	0.000	0.674
	Creation and dissemination	0.718	0.088	0.774	8.187	0.000	0.598
	Emotion and communication	0.851	0.060	0.903	14.138	0.000	0.816
	Cooperation and collective action	0.856	0.066	0.887	12.875	0.000	0.787
	Relief and release	0.756	0.062	0.876	12.188	0.000	0.767
Behavior and willingness to use TikTok	Convenience and trust	0.939	0.057	0.875	16.539	0.000	0.765
	Creation and dissemination	0.935	0.055	0.878	16.853	0.000	0.772
	Emotion and communication	0.930	0.058	0.869	16.109	0.000	0.755
	Cooperation and collective action	0.936	0.067	0.837	14.009	0.000	0.700
	Relief and release	0.949	0.065	0.848	14.646	0.000	0.719

5. Discussion

5.1. Implications and Suggestions

The results of all three social media analyses showed that the use of ICT had a positive impact on resilience.

First, in terms of convenience and trust, social media may be a more reliable form of media than traditional media in a disaster situation [18]. In addition to reliability, social media might potentially offer a more rapid and efficient means of disseminating accurate disaster information [62]. In the face of natural disasters, governments and communities must be the first to respond to the public's needs and expectations during disaster risk

communication efforts, which means using social media platforms to continuously track the public's information needs during natural disasters, such as the need for information about the disaster situation, disaster relief, casualties, and disaster supplies. This can facilitate the public's access to this information while satisfying the public's information needs, ensuring the public's trust.

Second, in terms of creation and dissemination, social media tools are usually more reliable than others in disaster situations, so they can be used to ask for help after a disaster [63,64]. Social media provides a new way for individuals and organizations to communicate during disasters, allowing for the rapid spread of information and the mobilization of resources [65]. Relief information is posted through social media in order to access relief and help more quickly. Policymakers need to formulate relevant emergency and disaster response plans based on the different stages of disasters and, more importantly, based on the characteristics and functions of social media. In this way, plans can target different modes of information production and dissemination to ensure that the public can quickly and accurately access relevant information about the disaster.

Next, we examined emotion and communication. Individuals often need a place to communicate and share information with others if the level of damage caused by a disaster is significant. Social media can help with these processes [21,66,67]. In the midst of and following a disaster, individuals will be seeking reassurance that their loved ones who may be in the impacted region are safe.

Cooperation and collective action are mainly reflected in the provision and receipt of preparedness information through social media in the event of a storm disaster. During a disaster, populations that are well informed and prepared are likely to be more resilient and flexible [68,69]; thus, individuals and organizations strive to learn how to prepare for disasters, and the dissemination of preparedness resources via organizations and governments benefits communities [18]. In terms of social impact, the government should not only ensure the effective use of online content and interaction but also make efforts to connect with the community offline, e.g., by reaching out to the community, etc., so that the official social media accounts operated by the government will be trusted by the public and become an important channel of information for them. When a disaster strikes, these social media accounts can play a role in improving the effectiveness of communication and prompting collaboration across multiple platforms.

Finally, we investigated relief and release. Social media may encourage positive attitudes and emotions that enhance behavioral and mental health. Social media may provide people with the opportunity to share their feelings about the incident, voice their concerns for those it has touched, express gratitude for their blessings, and mourn and remember those who died as a result of the event [64,66,70–72]. Therefore, the dissemination of emergency and disaster information must be based on ensuring the accuracy of the information, and it must be possible for the public to access disaster information very easily, especially in disaster situations where people are also in a state of fear. It is extremely important for disaster information to be timely, accurate, authoritative, and easily accessible so as to effectively alleviate the anxiety and panic of the affected members of the public. Different emergency management departments and other relevant organizations need to work together efficiently to complete a rapid assessment of events, improve the speed and efficiency of disaster responses, and combine information related to early warnings, developments, response measures, and public psychological care.

5.2. Limitations

While this study does provide insight into how the use of social media can enhance disaster resilience, it is worth noting its limitations. First, the results showed that social media (WeChat, TikTok, and Weibo) usage had a positive impact on community disaster resilience in relation to the variables of convenience and trust, creation and dissemination, emotion and communication, cooperation and collective action, relief and release, and usage behavior and willingness during a rainstorm disaster. However, it cannot be said

that these variables encompass all factors relevant to the impact of social media usage on disaster resilience. Second, during the 7.20 rainstorm disaster in Henan Province in 2021, people did not use only these three social media platforms to obtain and disseminate disaster-related information. There may be other relevant social media tools, such as QQ, etc., depending on the population. Only three social media platforms were selected for this study. Finally, the subject of this study was specific and specifically limited to a rainstorm disaster. Whether the findings can be generalized to all natural disasters is not yet known, and further validation of the above findings based on increased data volumes may be carried out in future studies. In response to the limitations of this study, this study also provides ideas and prospects for subsequent research.

6. Conclusions

This study examined how community resilience was enhanced via the use of ICT resources during the Zhengzhou 7.20 rainstorm.

Based on the collected and analyzed questionnaire responses, the major conclusions are summarized as follows.

(1) The use of WeChat, TikTok, and Weibo had positive effects on community disaster resilience. Specifically, the use of social media by the general public (WeChat, TikTok, and Weibo) during this rainstorm disaster was positively related to convenience and trust, creation and dissemination, emotion and communication, cooperation and collective action, and relief and release.

(2) From the results of a comparative analysis of the specific differences in the use of these three social media platforms, it appears that TikTok was used by the largest number of people during the storm disaster. The highest level of user satisfaction was found among those who used WeChat, while the variable scores for TikTok was not the highest. Instead, WeChat had the highest variable scores, and the number of users and variable scores for Weibo were both in the middle. There were also sociodemographic differences between the users of the three types of social media.

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Abbreviations

ICT Information and communication technology

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