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The Role of Social Media and the Crowd in Building Digital Community Resilience: Boundary Spanning during Disasters

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The Role of Social Media and the Crowd in Building Digital Community Resilience: Boundary Spanning during Disasters

Completed Research Paper

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Abstract

The increasing frequency of disasters poses severe challenges to communities. In this study, we propose the concept of digital community resilience, which refers to a dynamic process of using digital technologies to support community recovery from a disaster. Among various disaster stakeholders, the crowd represents a powerful force. The crowd leverages social media platforms to contribute to digital community resilience. However, the resulting crowd actions are not always seamless. Rather, they encounter ongoing boundary coordination issues with other stakeholders. We conducted a case study of China's response to COVID-19, focusing on the crowd's efforts and the transforming of boundaries with the government and the public. This study identifies three types of boundaries faced by the crowd – administrative, cognitive, and professional. We propose a process model of digital community resilience showing how different disaster stakeholders use social media to span boundaries after a disaster.

Keywords: Digital community resilience, crowdsourcing, boundary spanning, social media

Introduction

Disasters are characterized by *events that disrupt the functioning of a community and surpass its capacity to counteract using its available resources* (IFRC, 2021; WHO, 2002). Having witnessed frequent disasters in recent years, there is growing interest among researchers in understanding how to maintain and strengthen the resilience of communities (Xie et al., 2022; Zhang, 2022). Community resilience pertains to *a dynamic process that connects a range of adaptive capacities, encompassing the efforts of individuals and the support of social networks to recover after a disturbance* (Norris et al., 2007). In the information systems (IS) field, scholars have engaged in extensive discussion on combatting disasters (Ågerfalk et al., 2020; Rai, 2020), triggering research on digital resilience¹, which involves developing adaptive capabilities

¹ In their recent MISQ editorial, Boh et al. (2023) expand the definition of “resilience” to incorporate “digital resilience”, describing it as “the capabilities developed with the use of digital technologies to absorb major shocks, adapt to disruptions, and transform to a new stable state”.

using technologies to withstand large-scale shocks (Boh et al., 2023). In these emerging studies, community-level efforts toward digital resilience present a great potential. For example, the disruptions to communities caused by COVID-19 have stimulated community members to use various social media (SM) platforms to help each other (Zhang, 2022). Some studies encourage learning from community practices to develop solutions that mitigate the impact of disasters and facilitate recovery from destruction (e.g., Sakurai & Chughtai, 2020). Considering this, our research aims to deepen the understanding of how technology can be leveraged at the community level to achieve resilience. Drawing on previous work, we propose the concept of *digital community resilience as a dynamic process of using digital technologies to connect adaptive capabilities from various stakeholders to support community response and recovery following disruptions*.

As this definition reveals, cultivating digital community resilience requires a networked structure of multi-stakeholder involvement and cooperative efforts. However, attention to collaboration issues during disasters is lacking in current IS research. This has prompted a recent call for further investigation into the influence of technology on cross-stakeholder cooperation in the development of resilience (Boh et al., 2023; Sakurai & Chughtai, 2020). In this paper, we recognize the crowd as a powerful social force for disaster response rooted in the community (Kankanamge et al., 2019). In carrying out disaster-related activities, the crowd actors need to coordinate with other stakeholders, especially the government and the public. Here we take a process perspective to examine the evolving relationship among these disaster stakeholders, as mediated by SM, to offer novel insights into the dynamics of building digital community resilience. Accordingly, our research is guided by the following question: *In the process of building digital community resilience, how does social media contribute towards the transformation of relationships between disaster stakeholders?*

To address this research question, we conducted an in-depth interpretive case study (Klein & Myers, 1999) of the response to COVID-19 in China. China was the first country to report confirmed cases and implemented population-wide action to achieve low infection rates and halt the spread of the disease. We began this two-year case study just as the pandemic started. The first author gathered data from semi-structured interviews, social media, websites, and official news sources. We analyzed the case using the theoretical lens of boundary spanning. It allowed us to capture the dynamic characteristics of boundary actors and boundary objects to explore how multiple actors utilize digital technology such as SM to transition from independence to interconnectivity and, ultimately, collaboration in order to foster digital community resilience.

Our main theoretical contribution is to offer a process model of emerging digital community resilience where the role of SM, as it is employed by crowd actors to interact with government and the public, changes alongside shifting boundaries.

Literature Review

Crowd Involvement in Disasters

Crowd involvement has been recognized as an important element of disaster relief (e.g., FEMA, 2022; UNDRR, 2015). The crowd refers to *a generic mass of people involved in a specific task, who can be independent individuals, formal or informal groups, or other organizations* (Durward et al., 2020; Estellés-Arolas & González-Ladrón-de-Guevara, 2012). Due to the local scale of disaster occurrence, official responses emphasizing routine procedures and hierarchies may not be flexible and agile enough to meet multiple, uncertain, and complex emerging needs in chaotic environments (Nan & Lu, 2014). Therefore, local crowds are often among the first responders (Graveline & Germain, 2022). They are able to self-organize through participatory processes to help those at risk or who are suffering (Leong et al., 2015).

The widespread use of SM has been a major factor enabling crowd involvement in disaster response. Individual crowd members and local communities (e.g., various social organizations) use SM to share information, coordinate action, and offer resources that can help affected communities to help themselves. Government agencies and disaster response organizations often leverage these resources for effective disaster response (Kotlarsky et al., 2022) and resilience building (UNDRR, 2019). An early case of crowd involvement in disaster via SM was reported during the 2007 California wildfires, when the crowd primarily used SM to seek help and get situational updates when evacuation information was slow to come though

from official sources and traditional media (Sutton et al., 2008). The 2010 earthquake in Haiti was a turning point in the emergence and recognition of crowd power in disasters (Liu, 2014). An ad-hoc group of tech bloggers launched a crowdsourcing platform, Ushahidi-Haiti, to gather SM information and allocate relief resources. Haiti showed that capable individuals are able to respond to calls from local government for SM information translation, geocoding, and classification (Gurman & Ellenberger, 2015; Liu, 2014). As a result, governments are increasingly recognizing the potential of user-generated contextualized content on SM to facilitate disaster relief and recovery, including through rapid access to scenario awareness (Gour et al., 2022; Kankanamge et al., 2020), helping with damage assessments (Li et al., 2021), and accommodating the information and knowledge needs of disaster response (Bhuvana & Arul Aram, 2019; Mirbabaie et al., 2020). Table 1 provides a summary of key studies focused on crowd involvement via SM during disasters.

Our review of research on crowd involvement in disasters highlights that SM is bringing the importance of crowd involvement to the forefront, primarily through the data contributed by SM users to other disaster relief parties in the disaster response phase. Some studies have emphasized the position of the crowd among disaster stakeholders. For example, Kim and Hastak (2018) argue that individuals are at the core of social networks, connecting peripheral government and business organizations to communities. Ogie et al. (2018) further suggest that governments should consider SM users as human sensors during disaster response and involve them in disaster management depending on their reliability. By bridging the boundary between government, crowd actors and the wider community (hereafter referred as “the public”), SM empowers crowd actors to contribute their relief efforts at a flexible scale and in flexible forms.

Yet little is known about the dynamics of interactions between different crowd actors and official bodies (e.g., government authorities, official disaster response organizations) and the public (i.e., those affected by the disaster), and the role of SM in these interactions. Furthermore, the current work primarily focuses on how the crowd contributes to the response phase, with a limited exploration into how they assist disaster-affected communities in returning to normalcy or even bouncing forward to building digital community resilience.

Study	Disaster	Crowd Involvement	Role of SM
Gour et al. (2022)	COVID-19 outbreak in India, 2020	Crowd (SM users) contribute data containing rich content in the form of people’s reactions, calls-for-help and feedback.	SM helps governments and healthcare organizations to gain insights into the situation and act accordingly.
Li et al. (2021)	Ridgecrest earthquake in USA, 2019	Crowd (SM users) are additional and novel data source.	SM data is used for rapid damage assessment after sudden-onset hazard events and to identify insights related to potential challenges.
Kankanamge et al. (2020)	South East Queensland floods in Australia, 2010–2011	Crowd (SM users) contribute knowledge related to disasters.	SM information has become an opportunity for authorities to obtain enhanced situation awareness data for efficient disaster management practices.
Roy et al. (2020)	Hurricane Sandy in USA, 2012	Crowd (SM users) engage in crisis communication.	SM offers a unique opportunity for crisis communication.
Mirbabaie et al. (2020)	Hurricane Harvey in USA, 2017	Crowd (information-rich actors) influence sense-giving from Twitter crisis communication.	SM facilitates crisis communication and information dissemination.
Yan & Pedraza-Martinez (2019)	Hurricane Sandy in USA, 2012	Crowd (SM users) share information such as the demand for aid, willingness to donate and availability to volunteer.	SM allows for information exchange and social engagement.

Bhuvana & Arul Aram (2019)	Chennai floods in India, 2015	Crowd (SM users) are content generators.	SM facilitates crisis communication and disaster management. SM information is an eye-opener to specific areas of resource needs and gaps in resource distribution, which will help in decision-making in real disasters.
Kim & Hastak (2018)	Louisiana floods in USA, 2016	Crowd is actively engaged to share information, communicate with communities, and update information.	SM plays a critical role in disaster management by propagating emergency information to a disaster-affected community.
Yoo et al. (2016)	Hurricane Sandy in USA, 2012	Crowd (SM users) are information diffusers.	SM networks are effective at passing information along during humanitarian crises that require urgent information diffusion.
Leong et al. (2015)	Floods in Thailand, 2011	Communities manage the challenges in crisis response.	SM can empower the community from three dimensions of process (structural, psychological, and resource empowerment) to achieve collective participation, shared identification, and collaborative control in the community.
Table 1. Selected IS Literature on Crowd Involvement via SM during Disasters			

Boundary Spanning as a Theoretical Lens

Boundaries define *the characteristics of a given domain, such as roles, functions, organizations, communities, or networks* (Aldrich & Herker, 1977). They can maintain internal stability but at the same time impede the flow of information across the domain. Boundary spanning was proposed in organizational studies as a way to access knowledge and achieve competencies outside the current domain, and has since been adopted in the IS literature (Levina & Vaast, 2005; Pawlowski & Robey, 2004). According to Aldrich and Herker (1977), boundary roles have two main functions: information processing and external representation. *Information processing refers to searching for external information and transforming it for internal use, while external representation involves communicating with outsiders on behalf of the organization, coordinating and resolving external conflicts, and enhancing social legitimacy.* On this basis, boundary spanning can be seen as *the interaction between the organization and external stakeholders to reduce uncertainty and promote value co-creation through knowledge interchange.* Alongside boundary roles, the concept of the boundary object has also been developed (Star & Griesemer, 1989). Boundary objects are used to develop and maintain consistency across environments. They are a *broad range of artifacts that “are plastic enough to adapt to local needs and constraints of the several parties employing them, yet robust enough to maintain a common identity across sites”* (Star & Griesemer, 1989, p. 393). Some IT systems have been used as boundary objects to integrate information flows cross boundaries and for knowledge transfer (e.g., Pawlowski & Robey, 2004; Tim et al., 2017)

We consider boundary spanning as a relevant theoretical lens in the context of our research. First, given the diverse nature of disaster stakeholders (in our context these are (i) government, (ii) three different crowd actors – individual crowd members, and reputable and emerging social organizations, and (iii) the public), interactions between them will require boundary spanning. In this context boundary spanning is a process that unfolds as different disaster stakeholders – government, crowd actors and the public – reconcile multiple boundary constraints, establish connections, and negotiate channels through which support is provided to the population affected by a disaster, thereby forming digital community resilience. Second, the notion of the boundary object allows us to explore the dynamic nature of the coordination process among different groups (Carlile, 2002; Star & Griesemer, 1989), as mediated by SM in our case. Specifically, we consider SM as a boundary object used by disaster stakeholders during three distinct phases of disaster response for boundary-spanning purposes.

With this theoretical background in mind, our empirical study aims to explore the shifting boundaries between government, crowd actors and the public during an unfolding disaster, considering SM as a boundary object and examining its impact on this dynamic process.

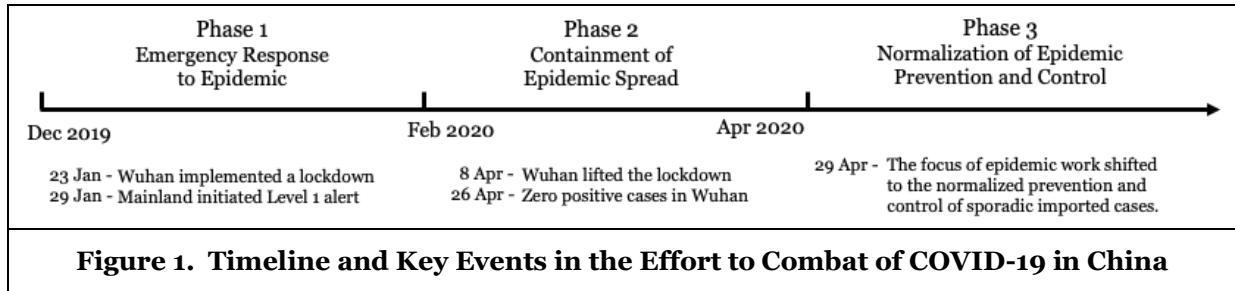
Research Design and Methods

We used an interpretive qualitative case study to examine changes at the boundary between different disaster stakeholders. This approach is suitable for answering “how” questions, thus aligning with our research aim of exploring the role of SM during the process of building digital community resilience among disaster stakeholders, and facilitating theory development as well as practical implications (Walsham, 1995). China during COVID-19 was chosen as the case study for two reasons. First, we wanted an interesting and illuminating case that would help generate insight into an underdeveloped research area and contribute to current knowledge (Myers, 2019). China was the first country to implement a lockdown, with remarkable results in controlling infection rates and revitalizing communities, thus providing potential lessons for how to build digital community resilience. Second, the political context of China creates a clear distinction between different actor groups – government and social organizations – and the status of these social organizations (e.g., reputable or newly emerging). Furthermore, as a global mega-health crisis, COVID-19 represents a noticeable shift in the disaster management field, with unprecedented crowd involvement, increasing recognition of the power associated with social groups, and widespread use of SM. These factors combined to offer a unique opportunity to explore and understand shifts in the relationship between the government and crowd actors.

The primary data was collected from semi-structured interviews conducted from February to April 2022. Eligible participants were those who had participated in or organized prevention and control-related efforts after the COVID-19 outbreak. Our key informants were leaders of the civic volunteer group and local community in which the first author was involved. The “snowball sampling” technique was used to obtain more candidates for interview (Myers & Newman, 2007). We interviewed 32 participants who included workers in nonprofits, citizen volunteers, university students, community workers, and members of grassroots government agencies, thus covering a range of experience as well as 15 provinces in China, among them Hubei Province – the area with worst outbreak. Each conversation lasted approximately 30 minutes. The mirroring technique was applied in the interviews (Myers & Newman, 2007), during which participants shared experiences of fighting the pandemic, including their motivations for participation, actions taken, challenges encountered, and reflections. Ancillary data were collected from archival information, which comprised epidemic-related posts on the interviewees’ SM accounts, blogs from their affiliated organizations, short videos, and related news coverage. The archival data spanned the period from the outbreak of COVID-19 in China (January 2020) to the data collection phase (April 2022). The data collection process followed the triangulation principles of the case study approach where multiple sources and forms of data are cross-validated to capture the complexity of context and create richer, more reliable insights (Myers, 2019).

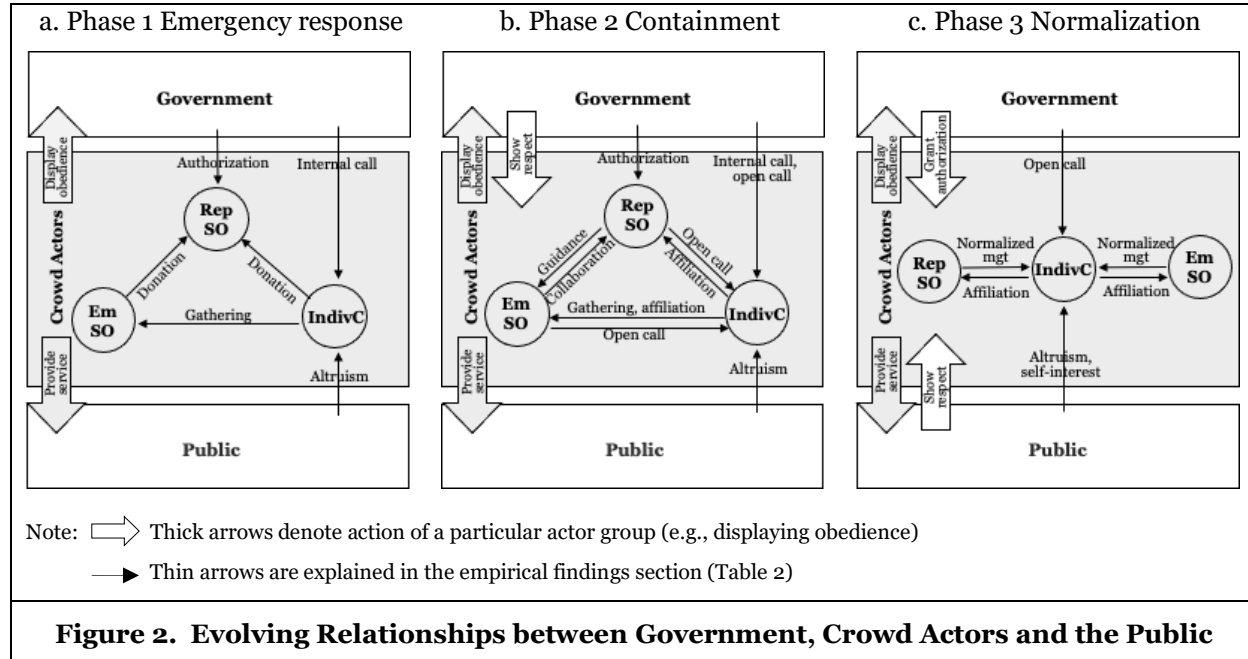
The process of data analysis of the interview content and archival information was inductive and iterative. Firstly, we focused on obtaining a rich picture of the interactions between the various disaster stakeholders seeking to fight the epidemic and build community resilience. To derive recurring process mechanisms from the data, we followed the combined strategy of temporal bracketing, and narrative and visual mapping introduced by Langley (1999). Figure 1 presents the timeline of key events across three phases in the fight against the outbreak in China. (1) Emergency response. In late 2019, a novel coronavirus (later named COVID-19) surged across Wuhan, Hubei Province, China, precipitating a swift pandemic escalation. By January 23, 2020, Wuhan enforced a lockdown and stringent traffic control. Concurrently, the central government established an epidemic management team to scrutinize pathogenesis and prompted provinces to craft contextually tailored emergency protocols (The State Council, 2020). As of January 29th, all regions within mainland China successively initiated high-level emergency alerts and implemented lockdown measures. (2) Containment of spread. Through collaborative efforts of various stakeholders involved, China effectively curbed the spread of the epidemic and maintained a low infection rate. By the end of February, many provinces had achieved zero inpatient cases and began to lift lockdowns and resume work. On April 26th, the region that had experienced the most severe outbreaks - Wuhan - reported zero hospitalized cases of COVID-19 (The State Council, 2020). (3) Normalization of prevention and control. The central government resolved to enhance the normalized prevention and control measures for imported cases. The

mainland then experienced sporadic outbreaks of regional epidemics several times, but all were brought under control within a few weeks. Next, we used sketch mapping to visualize the evolving relationships between stakeholders. We identified three major types of stakeholders: the government, the crowd, and the public. The crowd actors were categorized as reputable social organizations (RepSOs), emerging social organizations (EmSOs), and individual contributors (IndivCs). Their SM practices and interactions led us to the lens of boundary spanning, which was chosen as a “sensitizing device” through which to view and explore the digitally enabled boundary shifts among stakeholders (Klein & Myers, 1999). We then iterated between the theoretical lens, collected data, and findings until we achieved theoretical saturation (Pan & Tan, 2011), where the derived conceptualizations could fully explain the results of the case study.



Analysis and Findings

In this section, we illustrate the changes in the relationships between the government, three crowd actors, and public across the three phases (emergency response, containment, and normalization), the boundaries and boundary shifts observed, as well as the role of SM as a boundary object (summarized in Table 2). Figure 2 presents the evolving relationship between the different crowd actors, the government and the public. The meaning of the actions depicted by the arrows is elaborated in the analysis (see *italicized terms* in Table 2), and also explained in Appendix A.



Phase 1: Emergency Response – Analysis

Government: At the beginning of the outbreak, faced with an unknown virus and the surging spread of the disease, the government promptly formulated emergency decisions on lockdowns and traffic controls, and disseminated these policies through official SM accounts. The government granted

authorization to reputable social organizations (RepSOs) to assist in implementing the outbreak policies and handling *donations* from individual contributors (IndivC). In Wuhan, the most affected region, only five RepSOs, including the Red Cross, were officially allowed to receive the raised funds and goods. The deployment of these *donations* was subject to the centralization policy of the COVID-19 prevention and control headquarters at the provincial and municipal levels (Ministry of Civil Affairs, 2020a). But this policy quickly met with negative public opinion, expressed via SM channels such as Weibo. Due to the limited number of donation recipients, a bottleneck in supply collection and distribution emerged. The rigid management processes of the RepSOs and administrative approvals required from multiple Government departments led to inefficient service delivery to affected communities. To speed up the response, local governments issued *internal calls*, encouraging party members to take the lead in complying with the policies and volunteering to serve their communities; this constituted a top-down emergency response network (Figure 2a).

Crowd actors: As a result of the rapid spread of SM coverage of epidemic measures and the severe effects on communities of supply bottlenecks, several individuals (hereafter referred to as IndivC) volunteered to serve their communities and even *gathered* into groups – emerging social organizations (EmSOs) – to fight the epidemic together. Many volunteer fleets were formed to provide pick-up and drop-off services for medical supplies, as well as purchase, deliver, and distribute household goods to affected communities (China Business, 2020). These emerging forces used SM to document their anti-epidemic actions and bring positive energy to the affected communities. IndivCs and EmSOs took advantage of their domestic and international contacts to organize the procurement of personal protective equipment, which they passed on in the form of *donations* to RepSOs, in accordance with government regulations.

Public: Through information disseminated via official and informal SM channels, the public was able to quickly learn about the lockdown policy and gain situational awareness of affected communities. According to the interviewees' accounts, *altruism* (e.g., social responsibility, dedication spirit, etc.) was the main driver for public participation in epidemic services in the emergency phase. Many members of the public voluntarily contributed their time and effort to the anti-epidemic work (thus becoming IndivCs or joining one of EmSOs). As volunteers variously stated in the interviews: “*I am a party member. Seeing that the number of positive cases continues to rise every day, I petitioned the village cadres to participate in epidemic services*” (#32); “*The epidemic situation was serious, and relying only on community workers was not enough. On the premise that we can complete our tasks with high quality, we are willing to help out where needed*” (#25); “*My home is here, and I have the obligation and responsibility to protect it. Only in this way can I feel at ease*” (#22).

Phase 1: Emergency Response – Findings

Observed boundaries: During this phase we observed a significant *administrative boundary between the government and crowd actors*, with the government expecting all non-governmental organizations and individuals to display obedience and follow explicit government orders. Only RepSOs were authorized to handle epidemic materials, while IndivCs and EmSOs were considered to be a disrupting force on official order. As one IndivC interviewee stated:

The official team doesn't give us full respect. For example, they do not equip us with PPEs... I took the initiative to communicate with the leaders of the Health Bureau for the safety of volunteers and asked them to treat us equally... Finally, a consensus was reached... We handed over the custody of the PPEs to the transportation department, and those who need it can apply for it. (#21)

A distinct *cognitive boundary* was observed between the public and crowd actors. Under the traditional view of the government as the main provider of social governance, the public was accustomed to relying on the government and hesitant to recognize the role of other (non-government) actors. While several crowd members risked catching the infection and dedicated themselves to helping implement community lockdowns, these early voluntary contributions did not receive sufficient respect from the public. Under strict lockdown measures, the public inevitably showed anxiety, irritability, and made complaints, sometimes venting their anger on epidemic prevention volunteers (#25).

SM as a boundary object: In this phase, SM was used as an information tool by the government to quickly convey epidemic policies, regulate the actions of RepSOs and issue internal calls to action. SM also enabled crowd efforts to be immediately publicized and disseminated. Both RepSOs, EmSOs, and IndivCs used SM to popularize epidemic knowledge and promote policies. These crowd actors documented their practices and posted images of beneficiaries through various SM platforms. These epidemic-related posts, to some extent, evoked the public's sense of dedication and social responsibility to contribute. Under the strict community lockdown, SM served as the main channel for the public to get updates on the outbreak, comment on policies, and express emotions.

Phase 2: Containment – Analysis

Government: In response to negative public opinion on the centralized allocation of donated supplies and the positive action of EmSOs in helping to deal with distribution bottlenecks, the government acknowledged that the original policy was not suited to the current situation. The Ministry of Civil Affairs (2020b) updated their guidelines so that social organizations could now receive and allocate donations. There was no further reference to the strictly regulated receipt and use of donated supplies, but rather an emphasis on fully respecting the donors' will. This adjustment to the earlier policy reflects *respect* for the operation of social organizations (both RepSOs and EmSOs). Adding to this, the help-seeking hashtag (i.e., user-generated tags that can be cross-referenced to help, such as the need for an ambulance or medication) had long occupied the top spot on SM. Officials realized that the currently limited number of governmental personnel were unable to provide timely assistance and service to the affected communities and it was necessary to mobilize unofficial forces to help with outbreak services. Local governments started to use SM platforms to make *open calls* for crowd efforts and donations (Figure 2b).

Crowd actors: Following the government's open calls, RepSOs and EmSOs also started issuing *open calls* for increased crowd participation. This phase witnessed a significant increase in the number of IndivCs and more EmSOs were also formed. In compliance with regulations, individuals were encouraged to *affiliate* with existing social organizations. EmSOs were granted some degree of autonomy to carry out disaster relief and fundraising activities but were required to *collaborate* with RepSOs or operate under their *guidance*.

Public: The calls from government and social organizations were spread through online word-of-mouth, inspiring a greater sense of social responsibility among the public. The efforts of those already involved in epidemic service provided a robust positive demonstration, motivating more people to contribute their efforts. As described by two interviewees, "*Many news reports were about the hardships of the medical staff, who made a lot of contributions to the fight against the epidemic, which had a great impact on me*" (#9); "*I learned there were a lot of heroes in the fight against the epidemic through news via SM updates...I made some donation within my ability*" (#4).

Phase 2: Containment – Findings

Observed boundaries: The rapid increase of crowd participation in disaster response exposed a *professional boundary* with other trained disaster relief providers. The suddenness of the outbreak and urgency of community needs required the crowd to rapidly provide services, after undergoing only brief training. The inexperienced crowd was unable to provide satisfactory services for the affected community and faced public accusations such as "poor service quality", and "lack of preparation".

SM as a boundary object: SM served as a "window of opportunity" to facilitate crowd participation in resilience building and promote government–crowd collaboration. SM documented and witnessed the limitations of relying solely on official resources, as well as the effectiveness of the crowd actors (individual and social organizations) serving their local communities. This gave the government the impetus to seek external assistance, as well as the confidence to acknowledge the emerging crowd power for providing epidemic services. Consequently, SM has become a platform for the government and social organizations to call for capable individuals to make various contributions (donations of money, equipment, food and/or time to provide in-person services to affected communities). SM was also utilized as a tool for managing the registered volunteers, forming temporary service groups, facilitating crisis communication, and conducting training. In turn, SM provided a channel for the public to access recruitment information and register for pandemic-related services. SM also enabled the public to

become “online supervisors”, allowing them to comment on the practices of crowds and expose unreasonable actions.

Phase 3: Normalization – Analysis

Government: Given that crowd actors were providing locally tailored help to affected communities, the government realized that social support was essential to the fight against the epidemic and deserved to be encouraged and recognized. First, the government granted authorization for crowd actors to participate in disaster governance and post-epidemic activities. Specifically, the government established a fast track for EmSOs to supplement their registration process, which gave them administrative permission to raise funds and undertake projects to maintain daily expenses (#28). Moreover, during this phase, local governments implemented a “five to one” accountability mechanism², which formalized the crowd effort as an essential part of the outbreak strategy. The government also provided material and honorary rewards for social organizations and individuals who made outstanding contributions, such as by awarding certificates, setting up funds, covering insurance, and providing allowances. The government also publicly commended these crowd efforts on their SM accounts, which helped to foster a positive volunteer atmosphere and encouraged continued participation.

Crowd actors: As EmSOs and IndivCs were granted official recognition to carry out pandemic-related services, the relationship between the different crowd actors tended to equalize (Figure 2c). The continued need for crowd participation in recurring regional epidemics led to a *normalization* of interactions between these crowd actors. First, the recruitment channels were diversified. For example, many RepSOs and some EmSOs developed WeChat-based mini-programs, crowdsourcing documents, and discussion groups to recruit volunteers. Users only needed to scan the QR code or click the link to access the recruitment information and fill out the application form without having to download it. Coupled with the spread of recruitment information through SM, social organizations were able to efficiently recruit enough volunteers in a short period when faced with a sudden outbreak. Secondly, social organizations sought to cultivate a reserve pool of volunteers by offering regular training and rewards. Many social organizations and local governments collaborated to implement time-banking mechanisms (i.e., by recording service hours for volunteers, from which they can withdraw service time when needed) to establish a stable team of volunteers able to provide sufficient support during emergency periods (e.g., where there was a high demand for a particular service and/or high number of infected people). As explained by a community worker (representative of one EmSO):

We have set up a WeChat group for volunteers. The administrator is one of our staff members. When there is a need, we send out a notice to the group, and volunteers are always very responsive. We also have frequent communication when free, which is a kind of friendship. (#19)

Public: After the prevention and control work became normalized, especially by public praise, volunteerism became a social trend and won the public’s *respect*. During the interviews, many volunteers made comments such as: “*The public affirms what we do*” (#23); “*The villagers will share with us their own cooking and cakes, and restaurants give us free bills*” (#26); “*Being grateful and recognized by the residents has boosted my energy*” (#32). More importantly, more and more people were influenced by the spirit of dedication and joined the ranks of the volunteers. At the same time, public recognition affected the motives for participation. Some got involved in epidemic services for self-interested reasons, such as to gain social recognition and achieve self-fulfillment. As one social worker mentioned, “*Some may feel shame if they do not do anything.... It is against the values and social views*” (#31). Yet another volunteer leader commented, “*It’s a good sign that many are already following suit and learning from good examples... It is a positive herd effect*” (#22).

Phase 3: Normalization – Findings

SM as a boundary object: SM has become a crucial tool for the government in their efforts to build digital community resilience. In addition to continuing to use SM to update policies and issue open calls,

² The “five to one” accountability mechanism: five epidemic workers (one governmental cadre, one community worker, one healthcare provider, one police officer, and one volunteer) together serve one resident in quarantine.

the government employed SM as a management tool to support the operation of social organizations. The government has used SM to encourage sustained crowd participation in community recovery and reconstruction by publicly commending the crowd's contributions on official SM accounts, triggering a positive response from the public (also via SM channels, formal and informal). In our case study, different crowd actors were able to showcase their efforts, expand their visibility, seek collaboration and fundraising opportunities, and ultimately have sufficient funds to enhance their services to the community. For the public, the word-of-mouth promotion on SM platforms has continued to stimulate participation in building digital community resilience. Driven by a mixture of conformity, altruism, and self-interest, an increasing number of people have become contributors (individually and/or by joining social organizations), making volunteering a social trend.

Table 2. Analysis and Findings

Theorizing the Process of Building Digital Community Resilience

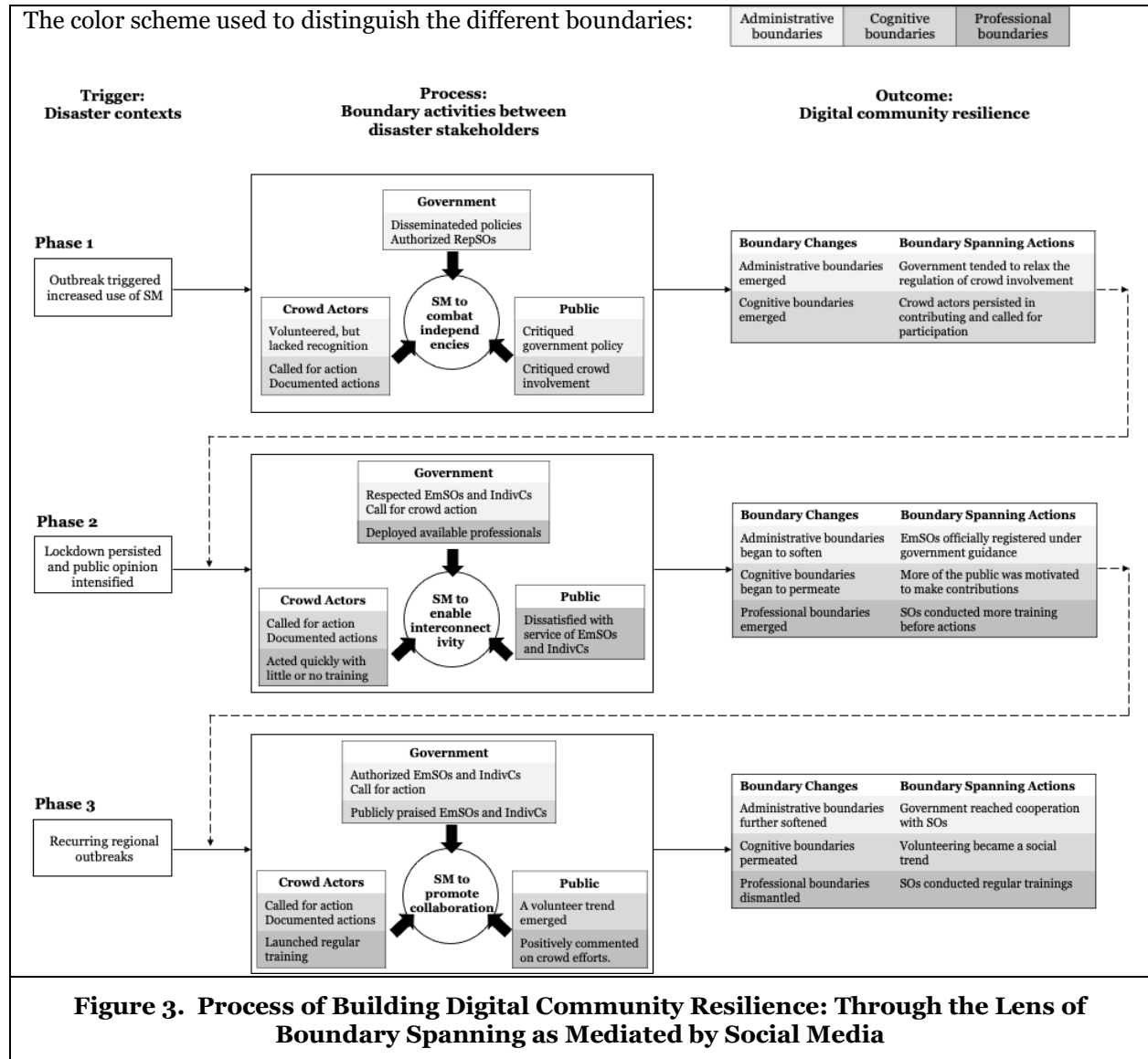
In this section we discuss how SM was used by different crowd actors to span boundaries as they were building digital community resilience during the unfolding pandemic disaster. As depicted in our findings, the three crowd actors faced a variety of administrative, cognitive, and professional boundaries. Figure 3 illustrates the dynamic process through which SM was used as a boundary object to span these boundaries, resulting in what we refer to as *boundary shifts*. We identified three SM-enabled mechanisms of boundary spanning. Specifically, our dynamic process depicts these shifts as the *softening* of administrative boundaries, *permeation* of cognitive boundaries and *dismantling* of professional boundaries.

Softening of Administrative Boundaries

The administrative boundaries impeding crowd actor participation in disaster relief and community resilience building were highly salient in the first phase of the outbreak. The government was the dominant player in relief operations, while social forces were informal and had difficulty gaining the government's attention. During the first phase SM was used primarily to *combat independencies* between disaster stakeholders, which eventually triggered actions by the government that enabled softening of the strict administrative boundaries for crowd actors involved in building digital community resilience. First, SM weakened the exclusive dominance of official sources over disaster information and broke down the barriers that previously hindered social forces from participating in crisis communication. The immediacy and communicative nature of SM enabled the crowd to communicate with and provide services to affected communities. Second, SM enabled crowd actors to showcase their profiles, intentions, and actions to others. In fact, this was particularly significant as the widespread use of SM increased in the context of COVID-19 lockdowns. Crowd actors shared information about their actions and experiences on SM, allowing other stakeholders to track their progress, which also helped to boost confidence in combating the pandemic among communities. The visibility of crowd efforts gradually fostered trust among government officials and the public. Third, SM endowed users with the right to oversee and comment on COVID-19 related practices. This created public opinion encompassing both criticism of official measures and accolades for social efforts, which served as an external force compelling the government to empower social organizations.

As a result, SM facilitated a softening of administrative boundaries between the government and the crowd. This was manifested in the government's gradual acceptance of crowd efforts and the move towards building collaborative partnerships between multiple crowd actors. SM made visible the roles played by crowd actors in various aspects of epidemic prevention and control, including raising funds, recruiting volunteers, safeguarding wellbeing, and promoting resilience. The government granted legitimacy to crowd actors and publicly acknowledged their efforts through SM, which was beneficial to incentivizing greater participation and unleashing the potential of these actors in building community resilience. However, despite the trend towards administrative softening, a remaining tension was that crowd actors were administratively dependent on the government – crowd actors provided resources or services under government policy and took actions that aligned with government expectations. Even for social organizations that operated spontaneously and voluntarily, their fund-raising had to be conducted under official supervision. In addition, as noted by the managers of some social organizations, they often had to negotiate with relevant government departments to obtain permits and approvals for their activities or

operations when attempting to grow their organization. This reflected the deeply ingrained traditional view of government-led disaster management, where administrative dependence has become a habit. The question of how to fully leverage the capacity of social organizations and construct a collaborative framework in building digital community resilience therefore remains unresolved.



Permeation of Cognitive Boundaries

We observed a shift in the cognitive boundary between the public and crowd actors. Under the traditional notion of government as the leading social governance body, the public was accustomed to relying on the government and did not recognize the role of other actors. However, when crowd actors spontaneously started implementing community lockdown measures, they were perceived by the public as challenging the status quo and thus received negative comments. SM thus *enabled interconnectivity* and eventually promoted *collaboration* between disaster stakeholders. It provided a platform for crowd actors to share their experiences and achievements, as well as promote the value and significance of crowd work to a wider audience. Crowd actors used SM to establish credibility by publicly showcasing their personal or organizational profiles, highlighting their skills, sharing donation data, and posting images of the people who benefited from their work. Dissemination of this information on SM created exposure and allowed a greater number of people to learn about the crowd's contributions, which in turn dispelled public

misconceptions and negative impressions of the contributions made by various crowd actors. Furthermore, through the impact of online word-of-mouth, the volunteer spirit garnered more attention and resonance among the public. In addition, the government's acknowledgment of crowd efforts, especially through public commendation on SM, accelerated the permeability of volunteerism.

Consequently, SM led to more permeable cognitive boundaries between crowd actors and the public. This was demonstrated by the fact that the public became immersed in the growing crowd participation in community-based pandemic services in the later phase of the pandemic. At the same time, tensions between the competing motivations for such participation came to light. On the one hand, some members of the public participated out of altruistic motives, such as dedication to contributing to community recovery efforts. On the other hand, some joined due to a herd mentality or for rewards in the form of recognition. We posit that the former is what truly drives the public to span the cognitive boundaries and gain the satisfaction that comes with volunteerism. However, in reality, in the urgency of dealing with the outbreak, there was significant reliance on external incentives to encourage participation. Central and local government utilized SM to create a stimulating environment that promoted crowd contributions. While this approach can generate widespread participation quickly, long-term promotion on SM might lead to online fatigue, ineffective permeation mechanisms, and hinder the sustainable cultivation of a volunteer pool.

Dismantling of Professional Boundaries

The extensive reliance on SM revealed the significant professional boundaries between crowd actors and trained rescuers. Specifically, SM empowered users from the public to express their views and opinions on the work done by crowd actors, as well as giving them the right to supervise, provide immediate feedback, and offer suggestions for improving any deficiencies in crowd work. In the early phases of the outbreak, public opinion against some volunteers highlighted issues of temporary recruitment, poor management, and inadequate experience among the crowd. These problems were even more pronounced during the surge in crowd participation, when there was a lack of manpower and time to conduct proper training for the diverse crowd. However, SM also served as a platform for knowledge sharing, where professionals could share their rescue experience, popularize epidemic knowledge, and conduct online training through live broadcasting. This provided a way for crowd actors to receive training. As the epidemic has become normalized, various social organizations have routinely incorporated online training and communication.

Overall, public opinion regarding crowd efforts tended to be positive, reflecting the initial dismantling of professional boundaries. However, the professional growth of the crowd was limited for several reasons. First, there was an issue of cost, as skills development required a significant investment in learning and practicing in terms of time and money. As part-time helpers, crowd actors needed to find a balance between fulfilling the expectations of their main occupation and the extra cost of acquiring rescue skills. The tight budgets of social organizations limited their ability to upgrade equipment and systems, affecting the scope and quality of their services. Second, a lack of practical opportunities hindered the growth of social organizations, many of which were only authorized to carry out marginal tasks such as distributing supplies and maintaining social order, with only the few RepSOs involved in the core tasks of epidemic response. It was evident that promoting further dismantling of professional boundaries would require more softening of the administrative boundaries between the government and crowd actors.

Conclusion

Our research makes three theoretical contributions. First, we develop the concept of digital community resilience, which introduces the term community resilience into IS field and responds to the research call for building digital resilience (Boh et al., 2023). By doing so, we can reduce potential confusion and controversy caused by borrowing concepts from other fields and instead improve an understanding of community resilience suitable for the IS domain. Our research also provides novel empirical evidence for building digital community resilience.

Second, we contribute to the IS literature on crowd involvement in disaster response by highlighting the importance of the crowd as a social structural force in building digital community resilience. In disaster situations the content of SM is often dominated by a few powerful providers (Boh et al., 2023), who tend to be official organizations (such as a government, in our case). Crowd involvement in relief efforts is relatively limited and primarily manifested through the contribution of disaster data provided by SM users

(e.g., Li et al., 2021; Mirbabaie et al., 2020). However, as our study portrays, cultivating community resilience requires not only information sharing (Mirbabaie et al., 2020), but also sustained engagement from different stakeholders and collaborative efforts from various entities (Boh et al., 2023; Sakurai & Chughtai, 2020). We argue that the crowd actors are crucial players for disaster relief among different stakeholders. We distinguish between the different crowd actors – individual contributors, reputable social organizations, and emerging social organizations, that formed as an immediate response to the unfolding disaster. Our study looks at the potential of the crowd in undertaking digital collaborative actions to address critical social challenges.

Third, we propose a process model of digital community resilience that elucidates the dynamic mechanisms of SM-mediated boundary spanning, thereby enriching the network concerned with building digital community resilience. Building upon previous research which primarily focused on boundaries rooted in information flow following disaster events (e.g., Tim et al., 2017), our research identifies three boundaries that emerged from the interactions between different crowd actors and other stakeholders – administrative, cognitive, and professional boundaries. We also revealed how these boundaries evolved over time, mediated by SM as the boundary object. The proposed process model depicts the role of SM in stakeholders moving from independence to interconnectivity, and ultimately collaboration. This enabled the softening of administrative boundaries, permeation of cognitive boundaries and, finally, facilitated the dismantling of professional boundaries as disaster stakeholders dealt with shifting boundaries. In this way, this investigation goes beyond the primary focus of earlier studies on SM's function in crisis communication and knowledge transfer (e.g., Gour et al., 2022; Kim & Hastak, 2018). Instead, we underscore its potential to promote cooperation among diverse stakeholders and build digital community resilience. Furthermore, we advance boundary spanning theory by conceptualizing the observed boundaries, boundary changes, and the role of SM as boundary objects. Our study shows that the mechanisms by which boundary objects come into play adapt to the constantly changing interactions among disaster stakeholders and disaster context, which provides insights into how technological artifacts can serve different transboundary purposes.

Our research also yields several practical contributions. First, the study demonstrates that crowd actors can play active roles in relief and take initiatives to leverage digital tools to span potential boundaries. Practitioners can foster ongoing interaction with crowd actors and develop actor networks that incorporate social forces to support disaster response and digital community resilience. Second, the study highlights the role of SM in broader disaster efforts, including how it can foster digital community resilience. These findings present practical knowledge for relevant relief agencies seeking to leverage SM to coordinate crowd resources and achieve relief objectives.

We acknowledge some limitations of our study. The first limitation relates to the generalizability of the selected case study. COVID-19 is a unique destructive event with a long duration and global wide-reach impacts. The response to the pandemic in China was unique and hence our findings may not apply to other types of disasters or cultural backgrounds. This study identifies the shifting patterns of administrative, cognitive, and professional boundaries. Among them, the administrative boundary between government and crowd actors may not be evident for low-impact disasters or in other countries, because additional administrative decentralization may not be a necessity to ensure smooth relief efforts. However, we still believe that the three-stage process model proposed can provide valuable insights for building digital community resilience during other disasters. The cognitive boundaries between the crowd and the public, as well as the professional boundaries between the crowd and professionals, remain applicable in other contexts. Moreover, although China employs SM platforms different from those used internationally, their functionalities are similar. These digital platforms, serving as boundary objects, retain their relevance for other contexts by combating interdependence, enabling interconnectivity, and promoting collaboration among disaster stakeholders. Hence, we encourage future research to engage in cross-case analyses, comparing boundary changes and SM's roles in different scenarios. Future work can also delve into how different countries and regions responded to the pandemic, including both the initial outbreak and the subsequent waves to explore more generalizable measures to build digital resilience in communities.

The second limitation arises from our data collection. The inherent constraints of interviews - artificiality and subjectivity - impact the extent to which interviewees divulge their accounts of pandemic-related services to an unfamiliar interviewer. Interviewees might withhold details they consider "sensitive," potentially introducing bias and incompleteness in the data (Myers & Newman, 2007). Furthermore, we have limited contacts and access to the number of interviewees. Our data may not encompass all types of

pandemic services and their associated challenges. For instance, our interviewees did not involve working on managing the overload of social media data. Future research endeavors could aim to provide a more comprehensive understanding by obtaining a more extensive and diverse set of interviewees. Additionally, while we interviewed government employees and different crowd actors, we lacked first-hand data from the business sector. Future research can further examine boundary issues involving corporate perspectives and other stakeholders, as well as how technology can be leveraged to make disaster efforts.

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Appendix A: Explanations of Actions Depicted as Arrows in Figure 1

Phases	Arrows	Explanations
1	Authorization	Giving government authorization to only certain RepSOs to conduct pandemic services, especially raising, accepting, and distributing donations.
1, 2, 3	Display Obedience	Displaying obedience to government policy is compulsory for all RepSOs, EmSOs, and InvidCs.
1	Internal call	Issuing of internal calls by the government for party members to assist in providing pandemic services.
1	Donation	Donations from EmSOs and InvidCs should be given to authorized RepSOs in accordance with regulations.
1, 2	Gathering	Gatherings of InvidCs to form EmSOs.
1, 2, 3	Provide Service	Provision of services (e.g., epidemiological survey, grocery delivery, etc.) to the public by various social organizations and InvidCs.
1, 2, 3	Altruism	Shows of altruism (e.g., social responsibility, dedication spirit, etc.) by the public through contributing to pandemic prevention and control.
2	Show Respect	The government showing respect to both RepSOs and EmSOs for their work collecting and distributing donations, arranging manpower, and carrying out pandemic activities.
2, 3	Open call	Open calls issued by the government or social organizations for InvidCs to contribute to pandemic services.
2, 3	Affiliation	Affiliating with the government or social organizations was encouraged for better management of InvidCs.
2	Guidance	RepSOs provided guidance to EmSOs on requirements for conducting fundraising.
2	Collaboration	Engaging in collaboration with RepSOs sought by EmSOs to conduct pandemic services.
3	Grant Authorization	Giving government authorizations to EmSOs and InvidCs who officially register with the government to conduct pandemic-related activities.
3	Normalized management	Adopting “normalized” management practices (e.g., continuous recruitment, regular training, rewards, etc.) of InvidCs by the government and various social organizations.
3	Show Respect*	The public showing respect to social organizations and InvidCs who made contributions to pandemic services.
3	Self-interest	Exhibiting self-interested reasons (e.g., to gain rewards, positive emotional experiences, reputation, etc.) for participating in epidemic services.