Papers included the literature review of crowdsourcing in the response to disasters

Table 1. Overview of literature review papers

#	Author(s), year	Title	Description	Crowdsourcing Task	Platform
1	(Callaghan, 2016)	Disaster management, crowdsourced R&D and probabilistic innovation theory: Toward real time disaster response capability	The paper reviews disaster management literature and justifies probabilistic innovative approaches, such as through crowdsourced R&D and social media technologies, support a new era of knowledge management that can help improve real-time disaster response and resilience across contexts. The article derives a model that provides a taxonomy - 'post normal' science, Kuhnian 'normal' science and Lakatosian 'structural science' - to facilitate disaster problem solving and research.	Information flow	Social media
2	(Houston *et al.*, 2014)	Social media and disasters: A functional framework for social media use in disaster planning, response, and research	The article develops a disaster social media framework through a comprehensive review of online, official and scientific literature. The framework includes communities, governments, individuals, organizations and media outlets and identifies 15 uses for the full disaster management cycle.	Information flow	Social media
3	(Luna and Pennock, 2018)	Social media applications and emergency management: A literature review and research agenda	This paper reviews and analyzes the literature regarding the benefits and challenges of applying social media to emergency management. Specifically, the benefits are: stakeholders with information as the event unfolds, a mechanism to alert larger audiences in less time, a platform to monitor public activities, as well as a tool where stakeholders can coordinate activities. The challenges lie in the interaction between stakeholders (social challenges) and the operation and maintenance of social media applications (technical challenges).	Information flow	Social media
4	(Martínez-Rojas *et al.*, 2018)	Twitter as a tool for the management and analysis of emergency situations: A systematic literature review	The paper systematically reviews the use of Twitter to emergency management and presents the challenges and future research directions in the interoperability, diversity, credibility, visualization, and regulatory initiatives of Twitter.	Information flow	Social media
5	(Spence *et al.*, 2016)	Social media and crisis research: Data collection and directions	The paper reviews the advances in the use of social media for recruiting participants, collecting data, and evaluating audience needs and expectations.	Information flow	Social media

6	(Pender *et al.*, 2014)	Social Media Use during Unplanned Transit Network Disruptions: A Review of Literature	The paper reviews social media's role in managing unplanned transit networks disruptions. Social media has a real-time/two-way nature and appeals to a wide audience, but it is resource-intensive and difficult to control. Crowdsourcing is beneficial for solving transportation agent resource issues and meeting the growing demand and expectations for real-time information.	Information flow	Social media
7	(Rachunok *et al.*, 2021)	A path forward for leveraging social media to improve the study of community resilience	The paper reviews the studies on the use of social media data to improving community resilience. It also guide the access, process and analyze twitter data along with explaining platform limitations.	Information flow	Social media
8	(Saroj and Pal, 2020)	Use of social media in crisis management: A survey	The paper reviews the papers centered around emergencies and its effect on social media and different organizations related to crisis management	Information flow	Social media
9	(Simon *et al.*, 2015)	Socializing in emergencies - A review of the use of social media in emergency situations	The paper reviews the literature concerning how SM tools are used in disasters by the public, emergency organizations and academic institutions.	Information flow	Social media
10	(Zhang *et al.*, 2020)	Social media for intelligent public information and warning in disasters: An interdisciplinary review	The paper systemically evaluate 304 studies in understanding the phenomena of communication on social media (from 5 aspects: content, spatiotemporal patterns, dissemination patterns, rumor and trust issues, public experience) and social media informatics techniques (in 3 categories: retrieval, integration, interpretation). These studies will support three functions of the Vision: acquiring situational awareness information, supporting help activities, and enabling management agencies to hear from the public.	Information flow	Social media (Q&A)
11	(Gaspar *et al.*, 2019)	Extreme natural and man-made events and human adaptive responses mediated by information and communication technologies' use: A systematic literature review	The paper reviews 60 articles on how people use ICTs to respond during extreme events, what ICTs-mediated responses take place during these, and why they respond in the way they do (i.e., the responses' adaptive functions).	Information flow	ICT
12	(Kankanamge *et al.*, 2019)	Can volunteer crowdsourcing reduce disaster risk? A systematic review of the literature	The paper reviews the role of volunteer crowdsourcing in disaster risk reduction, including its key attributes (location awareness, multi-directional communication, situation awareness, collective intelligence) and relevant technologies (geo-technology, mobile communication, digital crisis information, digital volunteerism).	Information flow	Crowdsourced volunteerism technologies

13	(Poblet *et al.*, 2018)	Crowdsourcing roles, methods and tools for data-intensive disaster management	The paper develops a typology of crowdsourcing roles and reviews the existing platforms and mobile applications leveraging crowdsourcing in disaster and emergency management.	Information flow	Mobile apps
14	(Yanxin Wang *et al.*, 2020)	Using Mobile Phone Data for Emergency Management: a Systematic Literature Review	The paper reviews 65 related articles on the use of mobile phone data for emergency management (in 5 themes: emergency situations, EM phases, types of applications, analysis perspectives, and types of mobile phone data).	Information flow	Mobile phone data
15	(Whittaker *et al.*, 2015)	A review of informal volunteerism in emergencies and disasters: Definition, opportunities and challenges	The paper reviews the definitions of volunteerism and offers a a broader definition of informal volunteerism and categorizes it into two type- 'emergent' and 'extending' volunteerism. The paper then discusses the implications and barriers for disaster management.	Manpower flow	ICT

Table 2. Overview of empirical studies on crowdsourced information flows in the response to disaster

	#	Author(s), year	Title	Disaster type	Crowdsourcing task	Platform
Crowd	1	(Beedasy et al., 2020)	Online community discourse during the Deepwater Horizon oil spill: an analysis of Twitter interactions	Oil spill	Sense making	Social media
	2	(Boas et al., 2020)	The role of social media-led and governmental information in China's urban disaster risk response: The case of Xiamen	Tropical storm (Typhoon in Xiamen 2019)	Sense making	Social media
	3	(Boulianne et al., 2018)	Does compassion go viral? Social media, caring, and the Fort McMurray wildfire	Wildfire	Sense making	Social media
	4	(Chen et al., 2020)	Unpacking the black box: How to promote citizen engagement through government social media during the COVID-19 crisis	Epidemic (COVID-19)	Sense making	Social media
	5	(Du et al., 2017)	Exploring the Role of Social Media and Individual Behaviors in Flood Evacuation Processes: An Agent-Based Modeling Approach	Flood	Sense making	Social media
	6	(Flores-Saviaga and Savage, 2020)	Fighting disaster misinformation in Latin America: the #19S Mexican earthquake case study	Earthquake	Sense making	Social media
	7	(J. Guo et al., 2021)	Why do citizens participate on government social media accounts during crises? A civic voluntarism perspective	Explosion	Sense giving	Social media
	8	(S. J. Guo, 2017)	The 2013 Boston marathon bombing: Publics' emotions, coping, and organizational engagement	Terror attack	Sense giving	Social media
	9	(T. Kim, 2014)	Observation on copying and pasting behavior during the Tohoku earthquake: Retweet pattern changes	Earthquake	Sense giving	Social media
	10	(J. Kim and Park, 2020)	A framework for understanding online group behaviors during a catastrophic event	Tropical storm (Hurricane Harvey 2017)	Sense making	Social media
	11	(Leong et al., 2015b)	ICT-Enabled Community Empowerment in Crisis Response: Social Media in Thailand Flooding 2011	Flood	Sense giving	Social media
	12	(J. Li et al., 2019)	Using social media to call for help in Hurricane Harvey: Bonding emotion, culture, and community relationships	Tropical storm (Hurricane Harvey 2017)	Sense making	Social media

13	(L. Li *et al.*, 2018)	Characterizing information propagation patterns in emergencies: A case study with Yiliang Earthquake	Earthquake	Sense giving	Social media
14	(X. Lin *et al.*, 2016)	Exploring extreme events on social media: A comparison of user reposting/retweeting behaviors on Twitter and Weibo	Windstorm and smog	Sense making	Social media
15	(Z. Liu *et al.*, 2012)	Determinants of information retweeting in microblogging	Not specify	Sense giving	Social media
16	(Mirbabaie and Marx, 2020)	'Breaking' news: uncovering sense-breaking patterns in social media crisis communication during the 2017 Manchester bombing	Terror attack	Sense giving	Social media
17	(Neubaum *et al.*, 2014)	Psychosocial functions of social media usage in a disaster situation: A multi-methodological approach	Human stampede	Sense making	Social media
18	(Nilsen *et al.*, 2018)	Five reasons for using social media among young terror survivors: Results from the Utøya study	Terror attack	Sense making	Social media
19	(Rao *et al.*, 2020)	Retweets of officials' alarming vs reassuring messages during the COVID-19 pandemic: Implications for crisis management	Epidemic (COVID-19)	Sense making	Social media
20	(Shaw *et al.*, 2013)	Sharing news, making sense, saying thanks	Flood	Sense giving	Social media
21	(Silver and Matthews, 2017)	The use of Facebook for information seeking, decision support, and self-organization following a significant disaster	Tornado	Sense giving	Social media
22	(Sutton *et al.*, 2014)	Warning tweets: serial transmission of messages during the warning phase of a disaster event	Wildfire	Sense giving	Social media
23	(Z. Xu *et al.*, 2019)	Understanding public opinion in different disaster stages: a case study of Hurricane Irma	Tropical storm (Hurricane Irma 2017)	Sense making	Social media
24	(L. Xu *et al.*, 2020)	The Dynamic Effects of Perceptions of Dread Risk and Unknown Risk on SNS Sharing Behavior During EID Events: Do Crisis Stages Matter?	Epidemic (EID threats)	Sense making	Social media
25	(Yan and Pedraza-Martinez, 2019)	Social Media for Disaster Management: Operational Value of the Social Conversation	Tropical storm (Hurricane Sandy 2012)	Sense making	Social media
26	(Yoo *et al.*, 2016)	Evaluating information diffusion speed and its determinants in social media networks during humanitarian crises	Tropical storm (Hurricane Sandy 2012)	Sense giving	Social media
27	(Yuan *et al.*, 2020)	Understanding the evolutions of public responses using social media: Hurricane Matthew case study	Tropical storm (Hurricane Matthew 2016)	Sense making	Social media

	28	(Zhang *et al.*, 2020)	Public health and social media: A study of Zika virus-related posts on Yahoo! Answers	Epidemic (Zika)	Sense making	Social media
	29	(Zhong *et al.*, 2021)	Mental health toll from the coronavirus: Social media usage reveals Wuhan residents' depression and secondary trauma in the COVID-19 outbreak	Epidemic (COVID-19)	Sense making	Social media
Platform	30	(Alam *et al.*, 2020)	Descriptive and visual summaries of disaster events using artificial intelligence techniques: case studies of Hurricanes Harvey, Irma, and Maria	Tropical storm (Hurricanes in Atlantic 2017)	Data processing	Social media
	31	(Castillo *et al.*, 2013)	Predicting information credibility in time-sensitive social media	Earthquake	Data processing	Social media
	32	(Devaraj *et al.*, 2020)	Machine-learning methods for identifying social media-based requests for urgent help during hurricanes	Tropical storm (Hurricane Harvey 2017)	Data processing	Social media
	33	(Dutta *et al.*, 2018)	A system for intergroup prejudice detection: The case of microblogging under terrorist attacks	Terror attack	Data processing	Social media
	34	(Fang *et al.*, 2019)	Assessing disaster impacts and response using social media data in China: A case study of 2016 Wuhan rainstorm	Flood	Data processing	Social media
	35	(Freberg *et al.*, 2013)	Using value modeling to evaluate social media messages: The case of Hurricane Irene	Tropical storm (Hurricane Irene 2011)	Data processing	Social media
	36	(Han *et al.*, 2019)	Harnessing the power of crowdsourcing and Internet of Things in disaster response	Not specify	Technical support	Social media
	37	(Hao and Wang, 2020)	Leveraging multimodal social media data for rapid disaster damage assessment	Tropical storm (Hurricane Irma 2017 and Hurricane Harvey 2017)	Data processing	Social media
	38	(Hiltz *et al.*, 2020)	Exploring the usefulness and feasibility of software requirements for social media use in emergency management	Not specify	Technical support	Social media
	39	(Hong *et al.*, 2018)	Information Needs and Communication Gaps between Citizens and Local Governments Online during Natural Disasters	Windstorm	Data processing	Social media
	40	(Kirac and Milburn, 2018)	A general framework for assessing the value of social data for disaster response logistics planning	Earthquake	Data processing	Specialized (crowd mapping and resource tracking)

41	(Kumar *et al.*, 2020)	A deep multi-modal neural network for informative Twitter content classification during emergencies	Multiple (Hurricane Harvey, Hurricane Maria,Hurricane Irma, Mexico earthquake, Iraq earthquake, California Wildfire, Sri Lanka flood)	Data processing	Social media
42	(Loynes *et al.*, 2020)	The detection and location estimation of disasters using Twitter and the identification of Non-Governmental Organisations using crowdsourcing	Not specify	Data processing	Social media
43	(Ludwig *et al.*, 2015)	Social haystack: Dynamic quality assessment of citizen-generated content during emergencies	Windstorm	Data processing	Specialized (Social Haystack)
44	(Maresh-Fuehrer and Smith, 2016)	Social media mapping innovations for crisis prevention, response, and evaluation	Not specify	Technical support	Social media
45	(Nicholson *et al.*, 2019)	A spatial regression and clustering method for developing place-specific social vulnerability indices using census and social media data	Tropical storm (Hurricane Harvey 2017)	Data processing	Social media
46	(Pánek *et al.*, 2017)	The Crisis Map of the Czech Republic: the nationwide deployment of an Ushahidi application for disasters	Flood	Technical support	Specialized (Crisis Map)
47	(Pekar *et al.*, 2020)	Early detection of heterogeneous disaster events using social media	Not specify	Data processing	Social media
48	(Purohit *et al.*, 2013)	What kind of #conversation is Twitter? Mining #psycholinguistic cues for emergency coordination	Not specify	Data processing	Social media
49	(Qian *et al.*, 2019)	Social media based event summarization by user-text-image co-clustering	Not specify	Data processing	Social media
50	(Ragini, Anand, *et al.*, 2018)	Big data analytics for disaster response and recovery through sentiment analysis	Flood	Data processing	Social media
51	(Ragini, Rubesh Anand, *et al.*, 2018)	Mining crisis information: A strategic approach for detection of people at risk through social media analysis	Not specify	Data processing	Social media
52	(Riccardi, 2016)	The power of crowdsourcing in disaster response operations	Earthquake	Data processing	Social media

	53	(Rossi *et al.*, 2018)	Early detection and information extraction for weather-induced floods using social media streams	Flood	Data processing	Social media
	54	(Rudra *et al.*, 2018)	Classifying and Summarizing Information from Microblogs During Epidemics	Epidemic (Ebola)	Data processing	Social media
	55	(Safarnejad *et al.*, 2020)	Contrasting Misinformation and Real-Information Dissemination Network Structures on Social Media During a Health Emergency	Epidemic (Zika)	Data processing	Social media
	56	(Singh *et al.*, 2019)	Event classification and location prediction from tweets during disasters	Flood	Data processing	Social media
	57	(Smith *et al.*, 2018)	Social media dialogues in a crisis: A mixed-methods approach to identifying publics on social media	Terror attack	Data processing	Social media
	58	(Son *et al.*, 2019)	Content features of tweets for effective communication during disasters: A media synchronicity theory perspective	Flood	Technical support	Social media
	59	(Son *et al.*, 2020)	Using a Heuristic-Systematic Model to assess the Twitter user profile's impact on disaster tweet credibility	Flood	Data processing	Social media
	60	(W. Wu *et al.*, 2020)	Tracking spatio-temporal variation of geo-tagged topics with social media in China: A case study of 2016 hefei rainstorm	Flood	Data processing	Social media
	61	(Yuan and Liu, 2018)	Feasibility study of using crowdsourcing to identify critical affected areas for rapid damage assessment: Hurricane Matthew case study	Tropical storm (Hurricane Matthew 2016)	Data processing	Social media
Crowdsourcer	62	(Abedin and Babar, 2018)	Institutional vs Non-institutional use of Social Media during Emergency Response: A Case of Twitter in 2014 Australian Bush Fire	Wildfire	Knowledge management	Social media
	63	(Ai *et al.*, 2016)	A dynamic decision support system based on geographical information and mobile social networks: A model for tsunami risk mitigation in Padang, Indonesia	Tsunami	Relationship management	Social media
	64	(Ali, 2014)	Crowd-sourced Governance in a Post-disaster Context	Not specify	Relationship management	Specialized (Ushahaiti)
	65	(Al-Saggaf and Simmons, 2015)	Social media in Saudi Arabia: Exploring its use during two natural disasters	Flood	Knowledge management	Social media
	66	(Avery, 2017)	Public information officers' social media monitoring during the Zika virus crisis, a global health threat surrounded by public uncertainty	Epidemic (Zika)	Knowledge management	Social media

67	(Bhuvana and Arul Aram, 2019)	Facebook and Whatsapp as disaster management tools during the Chennai (India) floods of 2015	Flood	Knowledge management	Social media
68	(Brengarth and Mujkic, 2016)	WEB 20: How social media applications leverage nonprofit responses during a wildfire crisis	Wildfire	Knowledge management	Social media
69	(Deng et al., 2020)	Detecting information requirements for crisis communication from social media data: An interactive topic modeling approach	Explosion	Knowledge management	Social media
70	(Elbanna et al., 2019)	Emergency management in the changing world of social media: Framing the research agenda with the stakeholders through engaged scholarship	Not specify	Knowledge management	Social media
71	(Fan et al., 2020)	Crowd or Hubs: information diffusion patterns in online social networks in disasters	Tropical storm (Hurricane Harvey 2017)	Knowledge management	Social media
72	(Feldman et al., 2016)	Communicating flood risk: Looking back and forward at traditional and social media outlets	Flood	Knowledge management	Social media
73	(Guidry et al., 2017)	Ebola on Instagram and Twitter: How health organizations address the health crisis in their social media engagement	Epidemic (Ebola)	Knowledge management	Social media
74	(C. Guo et al., 2020)	Impact of information seeking, disaster preparedness and typhoon emergency response on perceived community resilience in Hong Kong	Tropical storm (Typhoon in Hong Kong)	Knowledge management	Social media
75	(Hacker et al., 2020)	Virtually in this together - how web-conferencing systems enabled a new virtual togetherness during the COVID-19 crisis	Epidemic (COVID-19)	Knowledge management	Social media (WCS)
76	(Intrieri et al., 2020)	Operational framework for flood risk communication	Flood	Knowledge management	Social media
77	(Jin et al., 2019)	Communicating about infectious disease threats: Insights from public health information officers	Not specify	Knowledge management	Social media
78	(Jung and Moro, 2014)	Multi-level functionality of social media in the aftermath of the Great East Japan Earthquake	Earthquake	Knowledge management	Social media
79	(Kaewkitipong et al., 2016)	A community-based approach to sharing knowledge before, during, and after crisis events: A case study from Thailand	Flood	Knowledge management	Social media

80	(Kankanamge, Yigitcanlar and Goonetilleke, 2020)	How engaging are disaster management related social media channels? The case of Australian state emergency organisations	Not specify	Knowledge management	Social media
81	(Kankanamge, Yigitcanlar, Goonetilleke, *et al.*, 2020)	Determining disaster severity through social media analysis: Testing the methodology with South East Queensland Flood tweets	Flood	Knowledge management	Social media
82	(Kavota *et al.*, 2020)	Social media and disaster management: Case of the north and south Kivu regions in the Democratic Republic of the Congo	Not specify	Knowledge management	Social media
83	(J. Kim *et al.*, 2018)	Emergency information diffusion on online social media during storm Cindy in US	Tropical storm (Cyclone Cindy 2017)	Knowledge management	Social media
84	(J. Kim and Hastak, 2018)	Social network analysis: Characteristics of online social networks after a disaster	Flood	Relationship management	Social media
85	(Lachlan *et al.*, 2016)	Social media and crisis management: CERC, search strategies, and Twitter content	Windstorm	Knowledge management	Social media
86	(Lai *et al.*, 2017)	Connecting the dots: A longitudinal observation of relief organizations' representational networks on social media	Tropical storm (Typhoon Haiyan 2013)	Relationship management	Social media
87	(Lee and Yu, 2020)	The impact of language on retweeting during acute natural disasters: uncertainty reduction and language expectancy perspectives	Flood	Knowledge management	Social media
88	(W. Liu *et al.*, 2018)	Tweeting about emergency: A semantic network analysis of government organizations' social media messaging during Hurricane Harvey	Tropical storm (Hurricane Harvey 2017)	Knowledge management	Social media
89	(Ma and Yates, 2017)	Multi-network multi-message social media message dissemination problem for emergency communication	Not specify	Knowledge management	Social media
90	(Ma and Yates, 2014)	Optimizing social media message dissemination problem for emergency communication	Not specify	Knowledge management	Social media
91	(McCormick, 2015)	New tools for emergency managers: An assessment of obstacles to use and implementation	Not specify	Knowledge management	Social media

92	(Mehta et al., 2017)	Trust, but verify: social media models for disaster management	Tropical storm (Cyclones and storm-related flooding)	Relationship management	Social media
93	(Mirbabaie, Bunker, et al., 2020)	Social media in times of crisis: Learning from Hurricane Harvey for the coronavirus disease 2019 pandemic response	Tropical storm (Hurricane Harvey 2017)	Knowledge management	Social media
94	(Mirbabaie, Ehnis, et al., 2020)	Digital Nudging in Social Media Disaster Communication	Not specify	Knowledge management	Social media
95	(Ogie and Perez, 2020)	Collaborative translation of emergency messages (Co-TEM): An Australian case study	Not specify	Knowledge management	None
96	(Ogie et al., 2018)	Participation Patterns and Reliability of Human Sensing in Crowd-Sourced Disaster Management	Flood	Relationship management	Social media
97	(Oren et al., 2020)	Twitter Communication During an Outbreak of Hepatitis A in San Diego, 2016-2018	Epidemic (hepatitis A)	Knowledge management	Social media
98	(Panagiotopoulos et al., 2016)	Social media in emergency management: Twitter as a tool for communicating risks to the public	Windstorm	Knowledge management	Social media
99	(Park and Johnston, 2019)	Intentionally building relationships between participatory online groups and formal organisations for effective emergency response	Not specify	Relationship management	Other (ICT)
100	(Pogrebnyakov and Maldonado, 2018)	Didn't roger that: Social media message complexity and situational awareness of emergency responders	Not specify	Knowledge management	Social media
101	(Pourebrahim et al., 2019)	Understanding communication dynamics on Twitter during natural disasters: A case study of Hurricane Sandy	Tropical storm (Hurricane Sandy 2012)	Knowledge management	Social media
102	(Rajput et al., 2020)	Temporal network analysis of inter-organizational communications on social media during disasters: A study of Hurricane Harvey in Houston	Tropical storm (Hurricane Harvey 2017)	Relationship management	Social media
103	(Rice and Spence, 2016)	Thor visits Lexington: Exploration of the knowledge-sharing gap and risk management learning in social media during multiple winter storms	Windstorm	Knowledge management	Social media
104	(Roy et al., 2020)	Understanding the efficiency of social media based crisis communication during hurricane Sandy	Tropical storm (Hurricane Sandy 2012)	Knowledge management	Social media

105	(Sachdeva *et al.*, 2017)	Social media approaches to modeling wildfire smoke dispersion: spatiotemporal and social scientific investigations	Wildfire	Knowledge management	Social media
106	(Sakurai and Adu-Gyamfi, 2020)	Disaster-resilient communication ecosystem in an inclusive society – A case of foreigners in Japan	Tropical storm (Typhoon Hagibis 2019)	Knowledge management	Social media
107	(Stewart and Gail Wilson, 2016)	The dynamic role of social media during Hurricane #Sandy: An introduction of the STREMII model to weather the storm of the crisis lifecycle	Tropical storm (Hurricane Sandy 2012)	Knowledge management	Social media
108	(Sun *et al.*, 2020)	Roles of information propagation of Chinese microblogging users in epidemics: a crisis management perspective	Epidemic (African Swine Fever)	Knowledge management	Social media
109	(Takahashi *et al.*, 2015)	Communicating on Twitter during a disaster: An analysis of tweets during Typhoon Haiyan in the Philippines	Tropical storm (Typhoon Haiyan 2013)	Knowledge management	Social media
110	(Tim *et al.*, 2017)	Digitally enabled disaster response: the emergence of social media as boundary objects in a flooding disaster	Flood	Knowledge management	Social media
111	(Wamba *et al.*, 2017)	Social media adoption and use for improved emergency services operations: the case of the NSW SES	Flood	Knowledge management	Social media
112	(Yan Wang *et al.*, 2021)	Examining risk and crisis communications of government agencies and stakeholders during early-stages of COVID-19 on Twitter	Epidemic (COVID-19)	Knowledge management	Social media
113	(D. Wu and Cui, 2018)	Disaster early warning and damage assessment analysis using social media data and geo-location information	Tropical storm (Hurricane Sandy 2012)	Knowledge management	Social media
114	(Y. Yang *et al.*, 2019)	Exploring the emergence of influential users on social media during natural disasters	Tropical storm (Hurricane Harvey 2017)	Knowledge management	Social media
115	(Yates, 2016)	The impact of focus, function, and features of shared knowledge on re-use in emergency management social media	Not specify	Knowledge management	Social media
116	(Yates and Paquette, 2011)	Emergency knowledge management and social media technologies: A case study of the 2010 Haitian earthquake	Earthquake	Knowledge management	Social media (wikis and SharePoint)

Table 3. Overview of empirical studies on crowdsourced other flows in the response to disaster

#	Author(s), year	Title	Disaster type	Crowdsourcing task	Platform
1	(Lin *et al.*, 2020.)	A big data-driven dynamic estimation model of relief supplies demand in urban flood disaster	Flood	Material flow	Mapping (Baidu Map)
2	(Schempp *et al.*, 2019)	A framework to integrate social media and authoritative data for disaster relief detection and distribution optimization	Tropical storm (Hurricane Harvey 2017)	Material flow	Social media
3	(X. Wu *et al.*, 2020)	Finding of urban rainstorm and waterlogging disasters based on microblogging data and the location-routing problem model of urban emergency logistics	Flood	Material flow	Social media
4	(Nilsang *et al.*, 2019)	Locating an ambulance base by using social media: a case study in Bangkok	Not specify	Material flow	Social media
5	(Behl and Dutta, 2020)	Engaging donors on crowdfunding platform in Disaster Relief Operations (DRO) using gamification: A Civic Voluntary Model (CVM) approach	Flood	Financial flow	Specialized (crowdfunding)
6	(Y. Li *et al.*, 2020)	A social fundraising mechanism for charity crowdfunding	Not specify	Financial flow	Social media
7	(Möller *et al.*, 2018)	#Strongerthanwinston: Tourism and crisis communication through Facebook following tropical cyclones in Fiji	Tropical storm (Cyclone Winston 2016)	Financial flow	Social media
8	(Cathcart *et al.*, 2018)	An Efficient Model for Designing Medical Countermeasure Just-in-Time Training During Public Health Emergencies	Epidemic (Zika)	Manpower flow	None
9	(Harris *et al.*, 2017)	The Involvement/Exclusion Paradox of Spontaneous Volunteering: New Lessons and Theory From Winter Flood Episodes in England	Flood	Manpower flow	None
10	(Lassiter *et al.*, 2015)	A robust optimization approach to volunteer management in humanitarian crises	Not specify	Manpower flow	None
11	(Nielsen, 2019)	Embracing and integrating spontaneous volunteers in emergency response – A climate related incident in Denmark	Flood	Manpower flow	Social media
12	(Rotolo and Berg, 2011)	In Times of Need: An Examination of Emergency Preparedness and Disaster Relief Service Volunteers	Not specify	Manpower flow	None
13	(Simsa *et al.*, 2019)	Spontaneous Volunteering in Social Crises: Self-Organization and Coordination	Refugee crisis	Manpower flow	None
14	(Thapa *et al.*, 2017)	Analyzing crisis response through actor-network theory: The case of Kathmandu living labs	Earthquake	Manpower flow	Social media (WCS)
15	(Trautwein *et al.*, 2020)	Satisfaction With Informal Volunteering During the COVID-19 Crisis: An Empirical Study Considering a Swiss Online Volunteering Platform	Epidemic (COVID-19)	Manpower flow	Specialized (Swiss online platform)

16	(D. Yang *et al.*, 2014)	Providing real-time assistance in disaster relief by leveraging crowdsourcing power	Not specify	Manpower flow	Specialized (a crowdsourcing disaster support platform)
17	(Gunessee *et al.*, 2018)	The social preferences of local citizens and spontaneous volunteerism during disaster relief operations	Flood	Manpower flow	Social media
18	(Dollery *et al.*, 2020)	Humanitarian co-production in local government: the case of natural disaster volunteering in Japan	Not specify	Not specified	None
19	(Lai *et al.*, 2019)	Unpacking the Network Processes and Outcomes of Online and Offline Humanitarian Collaboration	Tropical storm (Typhoon Haiyan 2013)	Not specified	Social media
20	(Miao *et al.*, 2021)	Responding to COVID-19: Community volunteerism and coproduction in China	Epidemic (COVID-19)	Not specified	None