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Eismann, Kathrin; Posegga, Oliver; Fischbach, Kai

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Opening organizational learning in crisis management: On the affordances of social media

Kathrin Eismann, Oliver Posegga^{*}, Kai Fischbach

Department of Information Systems and Social Networks, University of Bamberg, An der Weberei 5, 96047 Bamberg, Germany

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ABSTRACT

Research on the role of social media in crisis management has led to a deeper understanding of their affordances. This research, however, is fragmented, with a primary focus on crisis response. We lack a clear conceptualization of the affordances that social media offer by learning from them to prepare strategically for crises. Based on a systematic review of 128 papers, we inductively build a framework of social media affordances for organizational learning in crisis management. We discuss their role and interplay in strategic crisis management, focusing on organizational crisis learning, and outline avenues for future research based on this foundation.

Introduction

Crises caused by infrastructure breakdowns, product and service failures, violent attacks, and natural disasters pose significant threats to organizations' strategic goals (Seeger et al., 1998). To prevent the occurrence and contain the impact of crises, organizations must respond swiftly to emergent and ongoing events so they can sustain or restore operations. Converting crisis experiences into actionable learnings helps organizations adapt to their environments strategically. All this translates into a continuous cycle of organizational renewal in which the occurrence or possibility of crisis can trigger organizational learning processes that in turn increase organizational resilience and enhance the ability to learn and prepare for future events (Lampel et al., 2009; Williams et al., 2017).

Information systems (IS) research and other disciplines have explored the potential of using information and communications technology (ICT) – most prominently, social media – to open organizational resources and processes to the public to support organizations responding to crises. For instance, social media enable organizations to exchange crisis-related information irrespective of established organizational boundaries and command structures (e.g., Yates and Paquette, 2011), exchange information and knowledge with the public (e.g., Liu and Xu, 2018), and crowdsource funds, materials, and volunteer resources (e.g., Brengarth and Mujkic, 2016). In addition, they empower the people and communities affected to reestablish communication ties interrupted by crises, establish outlets for sharing reliable information, and identify opportunities for community action (e.g., Ahmed and Sinnappan, 2013; Kaewkitipong et al., 2016; Leong et al., 2015). Thus, social media provide opportunities for organizations to access and draw upon information and other resources provided by non-organizational users, integrate contributions those users make, and encourage self-organization and novel forms of organizing that span established organizational boundaries (Tim et al., 2017).

Social media provide opportunities not only for organizations to learn about a crisis as it occurs (i.e., *intra-crisis learning*), but also to

^{*} Corresponding author.

E-mail addresses: kathrin.eismann@uni-bamberg.de (K. Eismann), oliver.posegga@uni-bamberg.de (O. Posegga), kai.fischbach@uni-bamberg.de (K. Fischbach).

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integrate information, knowledge, and collaborative processes that reside beyond their established structures. Thus, they can allow organizations to access resources provided by non-organizational users (i.e., *open resources*), support participative processes that integrate citizens and other users beyond an organization's scope (i.e., *open processes*), and facilitate collaborative structures that integrate organizational and non-organizational users equally (i.e., *opening effects*). We find, however, that the focus of most research is operational, and little attention has been paid to how organizations can use social media to adapt to adverse environments beyond the threats posed by a particular crisis.

This review adopts a strategic perspective on the use of social media in organizational crisis management, focusing on the process of organizational learning. Our research question is: *What is the state of knowledge in IS research regarding how social media afford organizational crisis learning?*

Our conceptual framework combines organizational learning theory (Crossan et al., 1999), affordance theory (Volkoff and Strong, 2013), and openness (Schlagwein et al., 2017). This allows us to integrate insights from prior research to identify opportunities for action that social media may provide for organizational crisis learning, and to develop an understanding of how social media allow organizations to learn for and from crises, drawing upon open resources and processes and opening effects. To answer the research question, we employ a *theoretical literature review* aimed at synthesizing the contributions of prior research (Paré et al., 2015). The conceptual contribution of our work hence lies in providing an integrated perspective on how social media can afford organizational learning in crisis management, based on the rigorous and systematic analysis and integration of related IS research (MacInnis, 2011).

The remainder of this paper is structured as follows: Section 'Theoretical background and conceptual framework' delineates the paper's theoretical background and conceptual framework. Section 'Literature review and analysis' describes our review methodology. Based on that, Sections 'Review findings on organizational learning affordances provided by social media' and 'Review findings on open resources, open processes, and opening effects facilitated by social media' are overviews of the affordances of social media we have identified and the open resources, open processes, and opening effects they facilitate. Section 'Implications for organizational learning in crisis management: Discussion and research agenda' discusses the implications of our findings concerning how social media can hence support organizational learning through open resources and processes and opening effects, and spells out opportunities for future research. We conclude in Section 'Conclusions'.

Theoretical background and conceptual framework

To provide a conceptual foundation for our review of social media affordances for organizational learning in crisis management, we outline our perspective on crises and crisis management and provide background on organizational learning, social media affordances, and openness. We summarize our theoretical background in a conceptual framework.

Organizational crises

An *organizational crisis* is defined as a "specific, unexpected, and nonroutine event or series of events that create high levels of uncertainty and threaten or are perceived to threaten an organization's high-priority goals" (Seeger et al., 1998, p. 233). This broad definition includes ecological crises, business and other economic failures, sociotechnical disasters, and hostile attacks and other violent behaviors (Richardson, 1994), and thus encompasses, among others, natural disasters, pandemics, infrastructure breakdowns, product and service failures, violent attacks, and social unrest (Seeger et al., 1998).

Organizations affected by such events – including high-reliability organizations, emergency response and humanitarian relief organizations, governments, businesses, and self-organized communities – must make efforts to prevent their occurrence and minimize their impacts. When faced with the immediate threat of a crisis, organizations must rise to the challenge and employ operational capabilities and resources to adapt to and confront the situation. Beyond that, they must take strategic measures to gather information about potential risk sources so they can plan for the occurrence of crises and build resilience, learn about ongoing events and their impacts to allocate resources and continue or restart operations, collaborate with stakeholders and other organizations to coordinate responses, and eventually draw lessons from their own and other organizations' experiences and prepare for future events (Comfort et al., 2001; Lalonde, 2011). Thus, responding to crises poses both strategic and operational challenges for organizations and requires systematic efforts to learn from past events.

Organizational learning

Following Vera et al. (2011, p. 154), *organizational learning* is defined as "the process of change in individual and shared thought and action, which is affected by and embedded in the institutions of the organization." Organizational learning theory emphasizes the role of learning for strategic renewal (Crossan et al., 1999; March, 1991), that is, the continuous process of change that enables an organization to thrive in and adapt to its environment. This process is strategic in that it spans not only the individuals and groups within an organization but also the organization as a whole, at every level, including the environment within which it is embedded (Duncan and Weiss, 1979). Two focal mechanisms drive the process: *exploration*, which includes the organizational activities aimed at identifying new opportunities for learning and integrating new learnings into the renewal process; and *exploitation*, the application of what has been learned (Crossan et al., 1999). Tensions arise between the two mechanisms from their ambidextrous nature and interdependence: they must be executed simultaneously and continuously to enable organizational learning and strategic renewal (Werder and Heckmann, 2019).

Conceptualized as a process, organizational learning comprises four stages: intuiting, interpreting, integrating, and

institutionalizing (Crossan et al., 1999). *Intuiting* is the preconscious process through which individuals – within an organizational context – recognize patterns or possibilities from a personal stream of experiences. *Interpreting* is the process through which they explain the insights they gain from intuiting to themselves and others, both verbally and through other means of expression. *Integrating* is the process of developing a shared understanding and taking coordinated action based on that understanding as a result of spontaneous interactions among groups of actors. *Institutionalizing* is the process of establishing routinized action, which involves activities such as defining tasks, specifying actions to be taken, and establishing processes that ensure these activities and actions are enacted. Institutionalizing takes place within the confines of formal organization, characterized by continuous input-transformation-output relationships (Argyris, 1964).

These four processes are connected by *feedforward* and *feedback* mechanisms. The former refers to exploration routines that build on the output of learning processes at the individual (intuiting and interpreting) and group (integrating) levels to absorb them at an organizational level (institutionalizing); the latter, which work in the opposite direction, involves the diffusion of institutionalized learnings from the organizational to the individual level (Crossan et al., 1999). Fig. 1 summarizes the organizational learning framework and its core processes.

Organizational learning is a core mechanism in crisis management. Learning from crises is vital to develop the capabilities required to prevent their occurrence and limit their implications (Carley and Harrald, 1997). One defining characteristic of crises, however, is that *intra-crisis learning* – that is, learning to improve the response to a crisis as it occurs (Moynihan, 2009) – is notoriously difficult for organizations. Challenges are imposed in part by the disruptive nature of crises, which can prevent decision-makers from identifying and collecting the information required to inform and evaluate their actions. In addition to the sheer impact of crisis events, other factors, such as limited experience in dealing with crises as well as both cognitive and operational restrictions to information collection and processing, pose strong barriers to organizational learning in the critical impact phase of crises (Moynihan, 2008). Likewise, *inter-crisis learning* – that is, learning from crises to prepare for future events (Moynihan, 2009) – poses a challenge to most organizations. From a strategic point of view, the rigidity of an organization's core beliefs and assumptions, ineffective communication, and information difficulties, among others, can impede learning from crises (Smith and Elliott, 2007).

The complexity of an organization's external environment is an important characteristic of crisis learning. Organizational learning theory accounts for *internal* and *external* learning domains: the former describes learning processes that take place within organizational boundaries (i.e., individual learning, intrafunctional learning, interfunctional learning, and multilevel learning), whereas the latter refers to learning from the external environment (i.e., customer learning, competitor learning, network learning, and institutional learning; Bierly and Hämäläinen, 1995). The external environment becomes less well-defined during crises due to their complex and dynamic nature. As internal and external shareholders and stakeholders jointly participate in crisis-related activities, especially when using social media, the external domain quickly extends to the public and thus to a broad variety of individuals, communities, organizations, and institutions (Houston et al., 2015). Understanding how social media blur organizational boundaries and open organizational learning processes to the external environment is important to understanding how organizations can improve learning about and from crises.

Social media affordances

A growing number of papers in recent years demonstrate how the use of ICT, especially social media, can facilitate various organizational processes in crisis management, ranging from knowledge management (e.g., Yates and Paquette, 2011) to crowdsourcing (e.g., Brengarth and Mujkic, 2016) to stakeholder conflict management (e.g., Hauser et al., 2017). They provide opportunities for organizational learning and adaptation in crisis management, most notably by enhancing organizational memory and supporting

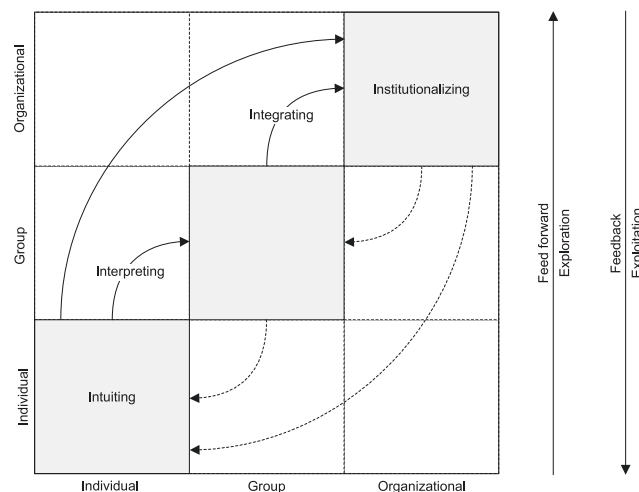


Fig. 1. Organizational learning process (Crossan et al., 1999).

communication (Robey et al., 2000).

While social media facilitate organizational learning in crisis management, however, little is known about *what* exactly makes this possible. A closer look at prior work on the subject reveals that crisis informatics research in IS and other disciplines has investigated the various individual, organizational, and social outcomes of using social media in crises, but mostly in isolation from each other. We also observe that IS research has focused on the implications of using social media during the crisis response phase, that is, dealing with the immediate and operational impact of a crisis as it unfolds. While this phase is crucial for crisis management and thus important to understand, focusing primarily on crisis response can lead to overemphasizing operational aspects of crisis management. As a consequence, while we might gain a deeper understanding of affordances related to information sharing and communication during crisis response, we may deprive ourselves of the chance to capture the implications of social media use for organizational change and adaptation in crisis management. In an effort to move towards a more comprehensive picture of social media affordances in the aforementioned context, we aim to understand how those affordances relate to the organizational learning process.

In our review, we focus specifically on the *affordances* social media provide for managing organizational crises. We understand affordances broadly as “what is offered, provided, or furnished to someone or something by an object,” in the sense that they refer to opportunities for action provided by an object (in our case, social media) that can, but need not, be actualized by goal-directed actors (Volkoff and Strong, 2013, p. 822). Affordances result from using ICT features to achieve some kind of outcome; as such, they describe the actions users are enabled to pursue to achieve their goals using a platform’s features (Leidner et al., 2018).

The concept of *openness* best describes one of the most prominent phenomena arising from the pervasiveness of social media and their affordances in organizational contexts. Schlagwein et al. (2017, p. 297) define openness as the “accessibility of knowledge, technology and other resources; the transparency of action; the permeability of organisational structures; and the inclusiveness of participation.” As a higher-order concept, openness follows four principles: transparency, access, participation, and democracy. These apply to resources (e.g., access and transparency of information and knowledge), processes (e.g., transparency of and participation in crowdsourcing and open innovation), and effects (especially democratizing effects, such as open business, open education, open government, and open science; Schlagwein et al., 2017). In practice, openness is a driving force of novel forms of organizing that thrive on the idea of strategically lowering organizational barriers and opening once exclusively internal resources and processes to participants outside the organizational container. Technologies such as social media play a focal role in this context, as they simultaneously enable and shape open phenomena, rendering the interplay between openness, ICT, resources, processes, and their outcomes – within and beyond organizational boundaries – a promising area of IS research (Schlagwein et al., 2017; Winter et al., 2014).

Conceptual framework

In the context of organizational learning in crisis management, we argue that the social media affordances provide the opportunity to open the organizational learning process by making it and the resources it requires and produces – such as information and knowledge – transparent and accessible to parties external to the organization. When referring to learning organizations, we focus on formal organizations that respond to organizational crises, such as businesses, emergency response organizations, and government agencies. External parties include a variety of actors that participate in crisis and disaster relief efforts, such as residents, communities, governments, news media, and other organizations (Houston et al., 2015).

Opening the learning process enables organizations to benefit from and contribute to simultaneously occurring learning processes within and outside of organizational boundaries through three classes of affordances, which we call internalization, externalization, and collaboration. *Internalization* refers to affordances that allow for the accumulation and use of external resources, such as knowledge and information, which result from external learning processes. *Externalization* refers to providing access to the outcomes of internal learning processes to parties outside of organizational boundaries. *Collaboration* comprises affordances that enable collaborative and democratic learning processes that span the boundary between organizations and external parties. We propose that those affordances contribute to opening the organizational learning process and unlock previously untapped opportunities for organizational learning that – if managed strategically – might allow for realizing synergies between internal and external learning that exceed traditional boundaries of both learning types by spanning organizational and industrial boundaries and incorporating resources offered by the public and external actors.

Fig. 2 summarizes the conceptual framework used to structure our review of social media affordances for organizational learning in crisis management. Based on the affordances identified in our review, we discuss their implications for the four core processes of organizational learning: intuiting, interpreting, integrating, and internalizing.

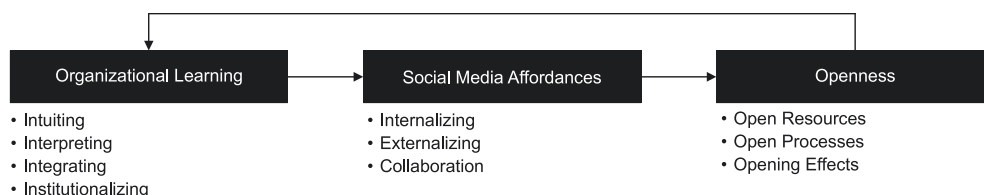


Fig. 2. Conceptual framework.

Literature review and analysis

We conducted a *theoretical review* to identify affordances social media provide for opening organizational learning in crisis management. Our goal was to synthesize the insights of conceptual and empirical studies from different strands of research, which provide the context for identifying, describing, and integrating concepts that are evident from prior research based on our conceptual framework (Paré et al., 2015, 2016). Theoretical reviews aim at explaining, that is, establishing the concepts that contribute to the dimensions of the conceptual framework and elaborating potential relationships between them (Rowe, 2014).

This goal distinguishes theoretical from other types of reviews, such as descriptive and scoping reviews, which aim at describing or understanding a field of research (Rowe, 2014; Templier and Paré, 2018). A significant difference between explanatory reviews and reviews aimed at understanding or describing is that they are concept-centric rather than paper- or author-centric (Rowe, 2014). While the latter, especially descriptive reviews, often rely on (primarily) quantitative research designs to provide insights into existing research on a specific topic, the former require in-depth analyses of the literature, including the interpretation, synthesis, and aggregation of previous works. Thus, theoretical reviews with the goal of explaining are ideally suited for qualitative research designs.

Following Paré et al. (2016), the review process consisted of a rigorous literature search and selection process that included a keyword-based search in eight indexing databases, systematic selection of relevant papers, iterative forward and backward searches based on the initially selected studies, and qualitative analysis of selected papers. Fig. 3 is an overview of the literature search, selection, and analysis process. Each step is detailed below.

To identify relevant studies, we conducted a keyword-based search in eight indexing databases: the ACM digital library, AIS electronic library, EBSCOhost information services, EmeraldInsight, IEEE Xplore digital library, JSTOR, Science Direct, and the Social Science Citation Index. Search terms were built around the two core concepts of our study: *social media* (defined as “user-driven platforms that facilitate diffusion of compelling content, dialogue creation, and communication to a broader audience”; Kapoor et al., 2018, p.536) and *crises* (defined as “specific, unexpected, and nonroutine event[s] or series of events that create high levels of uncertainty and threaten or are perceived to threaten an organization’s high priority goals”; Seeger et al., 1998, p. 233). Through a series of preliminary searches, we determined frequently used synonyms for both concepts and searched for singular and plural forms of each term. We searched all permissible combinations of the title, abstract, and keywords fields of each database without further restrictions on the types of entries, including all publications up to and including 2018. This resulted in a total of 7,702 hits across all eight databases. Appendix A includes the exact search phrases and the number of hits for each database.

From these initial hits, we selected relevant papers in three steps: format, content, and subject area screens. Appendix B details all inclusion and exclusion criteria. *Format screening* excluded all papers that were not peer-reviewed journal or conference papers, as well as those published in languages other than English. This allowed us to reduce the number of inclusion candidates to 4,465 papers.

Content screening excluded all papers we considered irrelevant to our research because they did not relate to both concepts of interest, namely, social media and crises. Two authors undertook content screening, simultaneously coding a subset of 10% (corresponding to $n = 770$ papers) of randomly selected papers to assess their relevance. After an initial round of training based on the codebook in Appendix B, both coders reached a strong level of agreement in both code categories, which is supported by a Cohen’s Kappa of 0.935 for the crisis criterion and 0.923 for the social media criterion, and a pairwise agreement of 96.7% and 96.2%, respectively. Differences in both categories were resolved through discussion until a consensus was reached. Each coder continued to apply the content screening criteria to one-half of the remaining papers. This process left 1,302 papers for further inspection.

Subject area screening aimed at reducing the number of papers to a reasonably manageable corpus while maintaining those studies likely of most interest to readers. We included only studies published in renowned IS journals and leading conferences. We relied on the Harzing journal list (66th ed.; Harzing, 2020) to guide inclusion decisions in the subject area screen, maintaining all papers from outlets in the “Management Information Systems, Knowledge Management” subject area that had received rankings in the top half of the Australian Business Deans Council (ABDC) and at least one other qualitative ranking released since 2015. Furthermore, we included papers from the proceedings of the International Conference on Information Systems (ICIS) and the Hawaii International Conference on System Sciences (HICSS) to capture emerging trends. We imposed no further restrictions on the type of papers included, thus retaining empirical, conceptual, design, and review papers. In a final round of data cleansing, we removed conference papers that were preliminary versions of journal articles already included in the corpus and substituted research-in-progress papers with their follow-up journal papers, leaving 92 papers for further processing.

In addition to the keyword-based search, we conducted forward and backward searches to identify papers that had cited previously included papers (through *Microsoft Academic*) or that had been cited by them. We repeated the process for three rounds until no further relevant articles could be identified. We selected from the remaining papers for further analysis all those that passed the same format, content, and subject area screening steps described above. This resulted in a total of 36 additional papers and a final set of 128 papers in total. Appendix C includes the complete list of papers included in the corpus.

Few of the selected papers refer explicitly to affordances provided by social media. Because these affordances result from the



Fig. 3. Overview of the literature review process.

interplay between social media platforms and their technological features on the one hand, and their users' goal-directed behavior in a given context on the other (Evans et al., 2017), we assume that they constitute the *logical link* (Neuendorf, 2017) between social media technologies and the uses they provide, which can be identified through qualitative content analyses of the papers.

Following Miles et al. (2020), we engaged in multiple successive coding cycles to identify the affordances implicit in each paper. First, to pre-structure the data, we identified statements in which the papers referred to the uses of social media in the context of crises, which could range from phrases to sentences to paragraphs. To qualify as relevant for our analysis, statements had to refer to both social media technologies (e.g., naming specific platforms, types of platforms, or their features), and how they were used in the context of a crisis (e.g., describing usage behaviors or intentions, or digital traces produced through such usage). This corresponds to our conceptualization of affordances as the logical link between social media technologies and technology uses. The statements identified were then treated as units of analysis for subsequent coding cycles.

Next, we inductively assigned process codes to the identified statements to characterize the activities or potentials for action that produced the uses of social media described in the papers, and, if stated in the papers, how they enabled organizational learning processes. As we engaged with the papers, we continually compared emerging codes and identified similarities in the identified action potentials. Moving back and forth between the papers and statements allowed us to integrate codes that expressed coherent and consistent themes and abstract from specific platforms, features, and uses. This resulted in a total of 15 codes, which correspond to the identified affordances of social media for internalizing, externalizing, and collaborating. These steps were then repeated to assign codes to how the identified affordances were related to open resources, open processes and opening effects in the papers. For those, analyses resulted in a total of 27 additional codes. Finally, we deductively grouped the identified affordances according to how they enabled organizational learning – that is, intuiting, interpreting, integrating, and institutionalizing – through open resources, open processes, and opening effects. Appendix D contains the codebook on which qualitative content analyses are based, along with the coding rules. Appendix E is a quantitative summary of coded themes. Appendix F includes the table of codes and the complete list of matched references for each.

Review findings on organizational learning affordances provided by social media

Based on the systematic literature review, we identified affordances of social media – five each pertaining to internalizing, externalizing, and collaborating processes. Below, we summarize our insights on each of them before discussing their relationship to open organizational learning in crisis management. We list selected references for each of the affordances in Tables 1–3. Appendix F includes the complete list of matched references.

Findings on affordances for internalizing

Affordances for internalizing allow organizations to access resources – primarily information and knowledge – shared by non-organizational users (e.g., community members, volunteers, media representatives, and responders from other organizations or organizational sub-units). Table 1 is an overview of these affordances, with definitions and selected references.

In particular, social media enable users to observe digital content that non-organizational users have contributed to social media presences, such as their digital profiles or community or collaborative spaces (*monitoring the information stream*). They can, for instance, keep track of digital content that features event-related markers, such as hashtags (e.g., Chatfield et al., 2014; Lachlan et al., 2016; Radianti et al., 2016), watch updates contributed to wikis, forums, and collaborative maps (e.g., Majchrzak and More, 2011; Palen et al., 2007; Reuter et al., 2014), follow contributions to digital profiles or other presences (e.g., Liu and Xu, 2018; Oh et al., 2011), join relevant groups (e.g., Ahmed and Sinnappan, 2013; Kaewkitipong et al., 2016; Neubaum et al., 2014; Tim et al., 2017), and establish

Table 1
Overview of social media affordances for internalizing.

Affordances	Definitions	Selected references
(1) Monitoring the information stream	Observing crisis-related digital content contributed to social media	Abedin and Babar (2018); Carter et al. (2014); Chatfield et al. (2014); Kaewkitipong et al. (2016); Liu and Xu (2018); Ludwig et al. (2015); Majchrzak and More (2011); Radianti et al. (2016)
(2) Automatically processing big (social media) data	Utilizing technological artifacts for collecting, analyzing, and displaying crisis-related digital content contributed to social media	Anderson et al. (2015); Hong et al. (2018); Horita et al. (2016); Mittelstädt et al. (2015); Mondal et al. (2018); Pogrebnyakov and Maldonado (2018); Ragini et al. (2018); Rudra et al. (2018)
(3) Tapping collective intelligence	Harnessing the outcomes of users' joint efforts to make sense of crises	Jong and Dücker (2016); Kaewkitipong et al. (2016); Leong et al. (2015); Majchrzak and More (2011); Nan and Lu (2014); Poblet et al. (2018); Subba and Bui (2017); Zhao et al. (2016)
(4) Accessing information providers	Identifying and consulting presumably knowledgeable users	Abedin and Babar (2018); Kaewkitipong et al. (2016); Liu and Xu (2018); Ludwig et al. (2015); Power and Kibell (2017); Semaan and Mark (2011); Stewart and Wilson (2016); Yates and Paquette (2011)
(5) Evaluating crisis response	Analyzing experiences gained from prior uses of social media in response to crises	Lee et al. (2017); Lin et al. (2016b); Maresh-Fuehrer and Smith (2016); Martínez-Rojas et al. (2018); Meesters et al. (2016); Osatuyi et al. (2012); Spence et al. (2016); Stewart and Wilson (2016)

Table 2
Overview of social media affordances for externalizing.

Affordances	Definitions	Selected references
(6) Contributing information	Making crisis-related digital content available to users through social media	Abedin and Babar (2018); Ahmed and Sinnappan (2013); Kaewkitipong et al. (2016); Majchrzak and More (2011); Liu and Xu (2018); Ogie et al. (2018); Shatte et al. (2016); Tim et al. (2017)
(7) Forwarding information	Sharing previously contributed crisis-related digital content with users beyond its original audience through social media	Abedin and Babar (2018); Chatfield and Brajawidagda (2014); Kim (2014); Kim et al. (2018); Lai and Tang (2018); Li et al. (2014); Lin et al. (2016a); Xu and Zhang (2018)
(8) Framing narratives	Contributing or forwarding digital content that conveys a particular interpretation of a crisis	Gaspar et al. (2016); He et al. (2018); Manika et al. (2017); Mazer et al. (2015); Meng et al. (2016); Omilion-Hodges and McClain (2016); Oh et al. (2015); Pang and Ng (2016)
(9) Establishing digital presences	Setting up and promoting outlets for contributing and forwarding crisis-related digital content through social media	Abedin and Babar (2018); Ahmed and Sinnappan (2013); Kaewkitipong et al. (2016); Leong et al. (2015); Majchrzak and More (2011); Oh et al. (2011); Palen et al. (2007); Tim et al. (2017)
(10) Communicating a reputation	Signaling the status and legitimacy of users contributing or forwarding crisis-related digital content through social media	Abedin and Babar (2018); Jong and Dückers (2016); Kim et al. (2018); Lachlan et al. (2014a); Lin et al. (2016b); Omilion-Hodges and McClain (2016); Power and Kibell (2017); Subba and Bui (2012)

Table 3
Overview of social media affordances for collaborating.

Affordances	Definitions	Selected references
(11) Negotiating consensus	Aligning perceptions and developing a shared interpretation of a crisis	Grabowski and Roberts (2011); Hauser et al. (2017); Heverin and Zach (2012); Jong and Dückers (2016); Leong et al. (2015); Mazer et al. (2015); Nan and Lu (2014); Purohit et al. (2013)
(12) Integrating contributions	Registering, monitoring, and deploying resources provided by users in response to a crisis in a coordinated way	Currión et al. (2007); Horita et al. (2016); Majchrzak and More (2011); Osatuyi et al. (2012); Palen et al. (2007); Rudra et al. (2018); Subba and Bui (2010); White et al. (2008)
(13) Crowdsourcing contributions	Calling for and incorporating resources to be provided by users in response to a crisis	Bergstrand and Stenmark (2016); Brengarth and Mujkic (2016); Chatfield and Brajawidagda (2014); Currión et al. (2007); Kaewkitipong et al. (2016); Kim (2014); Maresh-Fuehrer and Smith (2016); Poblet et al. (2018)
(14) Developing community	Advancing connections, sense of community, and collective action among users in response to a crisis	Abedin and Sinnappan (2013); Kaewkitipong et al. (2016); Lai et al. (2017); Leong et al. (2015); Liu and Xu (2018); Nilsen et al. (2018); Oh et al. (2015); Pang and Ng (2016)
(15) Establishing norms	Developing and enforcing principles for using social media to respond to a crisis collaboratively	Abedin and Babar (2018); Carter et al. (2014); Lachlan et al. (2016); Lin et al. (2016b); Oh et al. (2015); Palen et al. (2007); Subba and Bui (2012); Torrey et al. (2007)

relational ties to relevant users to receive automatic notifications of recent activities (e.g., [Abedin and Babar, 2018](#); [Getchell and Sellnow, 2016](#); [Lai et al., 2017](#)).

To facilitate monitoring, organizations can employ tools and methods for the automated collection and analysis of information streams (*automatically processing big (social media) data*). Actualizing this affordance can help organizations increase the efficiency of data collection, aggregation, and visualization (e.g., [Anderson et al., 2015](#); [Ludwig et al., 2015](#); [Mittelstädt et al., 2015](#)), and can allow for classifying themes of communication (e.g., [Horita et al., 2016](#); [Pogrebnyakov and Maldonado, 2018](#); [Rudra et al., 2018](#)) and detecting events from patterns of user activity (e.g., [Dutta et al., 2018](#); [Hong et al., 2018](#); [Mondal et al., 2018](#)). Social media hence allow organizations to engage in activities such as social listening and sensing, which, in turn, can enhance their situational awareness by providing access to information that might not otherwise be available within organizational boundaries – for instance, reports that signal the occurrence of damage, local impacts, activities undertaken by community members and unaffiliated responders, and rumors circulating among the population (e.g., [Hong et al., 2018](#); [Ludwig et al., 2015](#); [Mondal et al., 2018](#); [Radiani et al., 2016](#); [Wu and Cui, 2018](#)).

Furthermore, social media allow organizations to harness the outcomes of sense-making processes through which non-organizational users scrutinize crisis-related information available from social media and other sources, connect information from different sources, identify evidence for conflicting claims and interpretations, and aggregate and filter available information (*harnessing collective intelligence*). This allows organizations to tap into non-organizational information-processing capabilities, especially in support of information integration, validation, and corroboration (e.g., [Jong and Dückers, 2016](#); [Leong et al., 2015](#); [Majchrzak and More, 2011](#); [Nan and Lu, 2014](#); [Subba and Bui, 2017](#)).

Beyond the mere collection and appraisal of crisis-related information that homogenizes all user-generated content available, social media enable organizations to obtain information specifically from users who have particular knowledge or intelligence (*accessing information providers*), such as responders on the ground, locals familiar with a particular place, social media influencers and gatekeepers, technical experts, and digital volunteers (e.g., [Abedin and Babar, 2018](#); [Kaewkitipong et al., 2016](#); [Ludwig et al., 2015](#); [Semaan and Mark, 2011](#)). As a result, using social media can enhance not only organizations' situational awareness but also their ambient awareness by allowing them to identify users with particular information and retrace their connections to other users to locate

particular information or knowledge (e.g., Day et al., 2009; Yates and Paquette 2011). This, in turn, can facilitate actualizing affordances for collaborating, as it can enable establishing relational connections to sources of information outside an organization and interacting with non-organizational users to obtain relevant information from them (e.g., Lin et al., 2016b; Power and Kibell, 2017; Stewart and Wilson, 2016).

Looking beyond the individual crisis, affordances for internalizing also allow organizations to analyze crisis response activities and outcomes (*evaluating crisis response*). Evaluation can be retrospective, such as through collecting and analyzing digital traces of organizations' own and other users' communications from prior events, as discussed by Spence et al. (2016), or prospective, using social media to conduct crisis simulations and exercises (e.g., Meesters et al., 2016; Osatuyi et al., 2012). Thus, organizations can integrate prior experiences using social media in response to crises to develop and adapt their structures and processes and refine operational routines and procedures for future uses of social media. Evaluating crisis response can allow organizations, for instance, to identify novel roles for crisis managers to adopt using social media (e.g., Brengarth and Mujkic, 2016; Power and Kibell, 2017), devise and review plans and communication strategies (e.g., Lin et al., 2016b; Maresh-Fuehrer and Smith, 2016; Stewart and Wilson, 2016), and design and evaluate technological artifacts and social media platforms for future use (e.g., Ludwig et al., 2015; Reuter et al., 2014). Social media thus facilitate participatory research, allowing users to introduce their experiences and opinions into the organizational learning process.

Findings on affordances for externalizing

Affordances for externalizing can be actualized by organizations to make organizational resources, especially information and knowledge, available to non-organizational users. Table 2 is an overview of these affordances, with definitions and selected references.

Specifically, social media allow users to make crisis-related information available to non-organizational users through authoring or editing digital content that conveys information about a crisis event or response, such as status updates, blog posts, wiki entries, and labels on maps (*contributing information*). Again, the literature suggests that much of that information is situational, such as updates on crisis impacts and response operations, or contains warnings, instructions, or advice (e.g., Abedin and Babar, 2018; Ahmed and Sinnappan, 2013; Kaewkitipong et al., 2016). Contributing information to social media can allow organizations to disseminate information and contribute to non-organizational users' situational awareness, for instance, to inform and educate the public (e.g., Ahmed and Sinnappan, 2013; Carter et al., 2014; Liu and Xu, 2018). Moreover, using social media, organizations can lend credibility to their messages to increase users' compliance by, for instance, applying specific message formats (e.g., Chatfield et al., 2012), communicating in a regular and timely manner (e.g., Lachlan et al., 2014a), and utilizing credentials to signal trustworthiness and authority (e.g., Lin et al., 2016b).

In addition, organizations can use social media to reshare previously contributed digital content to users beyond its original audience, thus increasing the reach of crisis-related information they approve of or support (*forwarding information*). This affordance can be actualized by re-tweeting digital content or forwarding it to users for whom some information might be relevant or who might distribute it further, among other ways (e.g., Chatfield and Brajawidagda, 2014; Kwon et al., 2011; Lai and Tang, 2018). Social media can hence complement organizational crisis communications in other channels, allowing organizations to reach large and diffuse audiences efficiently (e.g., Abedin and Babar, 2018; Kim et al., 2018).

Contributing and forwarding digital content also allows organizations to communicate a particular interpretation of a crisis (e.g., its causes, implications, and actions to be taken), which in turn can influence how non-organizational users perceive an event or the focal organization's response (*framing narratives*). Thus, organizations can use social media to establish legitimacy of organizational goals and purposes, protect and enhance their reputation, and encourage particular behaviors or attitudes in non-organizational users, such as supporting an organization's response activities or taking particular actions such as avoiding certain products or seeking shelter (e.g., He et al., 2018; Omilion-Hodges and McClain, 2016; Yoo et al., 2016). Along the same lines, message frames can be used to influence the content and flow of crisis-related information in social media, with applications that include containing the spread of misinformation, disinformation, or hostile messages that question or attack an organization (e.g., Hauser et al., 2017; Oh et al., 2013; Stieglitz et al., 2018). The potential of using social media to frame crisis narratives implies that they can contribute to organizational risk and crisis communications beyond merely increasing the efficiency of information dissemination (e.g., Crijns et al., 2017; He et al., 2018; Ki and Nekmat, 2014; Roshan et al., 2016).

Beyond affordances that allow for different modes of information sharing, social media provide opportunities for organizations to operate dedicated presences through which they can provide crisis-related information (*establishing digital presences*), for instance, digital profiles such as Facebook pages (e.g., Ahmed and Sinnappan, 2013; Liu and Xu, 2018; Ross et al., 2018), Twitter handles (e.g., Abedin and Babar, 2018; Carter et al., 2014; Oh et al., 2011), or group or collaborative spaces (e.g., Majchrzak and More, 2011; Palen et al., 2007; Tim et al., 2017). Creating such outlets can enable organizations to draw an audience, establish relations to non-organizational users, and hence spread messages more efficiently to those for whom they might be relevant (e.g., Power and Kibell, 2017; Stewart and Wilson, 2016). Establishing digital presences can thus in turn influence affordances that enable information sharing through externalizing, and also facilitate affordances for collaborating through specifying dedicated communication channels (e.g., Lin et al., 2016b; Stewart and Wilson, 2016).

What is more, social media also allow organizations to build a reputation as a trustworthy source of information (*communicating a reputation*). To that end, they can provide official contact information, issue regular information updates, utilize platform-specific credibility indicators such as audience counts, and so on (e.g., Lachlan et al., 2014a; Lin et al., 2016b; Stewart and Wilson, 2016). Again, this affordance can influence other affordances for externalizing and increase the efficiency of information dissemination, increase organizations' influence over non-organizational users' sense-making, and facilitate collaborating with relevant audiences (e.

g., [Abedin and Babar, 2018](#); [Ahmed and Sinnappan, 2013](#); [Jong and Dücker, 2016](#); [Kim et al., 2018](#)).

Findings on affordances for collaborating

Affordances for collaborating allow users to align their activities in response to crises, putting forth and promoting novel modes of collaborative crisis management among and between established and emergent organizational actors as they build and expand upon the exchange of information and other resources afforded by social media. [Table 3](#) is an overview of these affordances, with definitions and selected references.

With respect to collaborating, organizational and non-organizational users can use social media to engage in conversations, offer their opinions, and express how they perceive a crisis, its causes and implications, and available response options, and discuss divergent interpretations of events and responses (*negotiating consensus*). Thus, social media can support sense-making processes and enable users across established organizational boundaries to develop a shared understanding of a crisis as they express their views and share personal experiences, propose and evaluate possibilities for action, and explain how divergent and potentially conflicting narratives might be reconciled (e.g., [Torrey et al., 2007](#); [Gaspar et al., 2016](#); [Heverin and Zach, 2012](#); [Nan and Lu, 2014](#)). This also allows users to develop a shared interpretation of what constitutes desirable or admissible uses of social media in crisis management, or frame users' perceptions of an organization's role within or in response to a crisis (e.g., [Crijns et al., 2017](#); [He et al., 2018](#); [Ki and Nekmat, 2014](#); [Meng et al., 2016](#); [Ross et al., 2018](#)).

Social media allow users across organizational boundaries to synchronize demands and requests for resources based on a shared purpose and understanding of how a crisis should be addressed in a bottom-up way (*integrating contributions*). This refers to informational resources made available for anyone to access and use, such as information about missing persons, the location of facilities, or personalized advice; beyond that, social media allow users across organizational boundaries to integrate and manage material

Table 4
Overview of open resources provided by social media.

Open resources	Definitions	Selected references
(A) Information	Digital content that conveys users' insights related to a crisis, in particular:	
(A1) Situational information	Information pertaining to crisis events, related resources, or activities	Abedin and Babar (2018) ; Chatfield and Brajawidagda (2013) ; Hong et al. (2018) ; Kaewkitipong et al. (2016) ; Ludwig et al. (2015) ; Lu and Yang (2011) ; Majchrzak and More (2011) ; Ogie et al. (2018)
(A2) Geo-location information	Information about the location of crisis events, related resources, or activities	Abedin and Babar (2018) ; Chatfield et al. (2014) ; Currion et al. (2007) ; Hong et al. (2018) ; Majchrzak and More (2011) ; Mirbabaie et al. (2016) ; Ogie et al. (2018) ; Reuter et al. (2014)
(A3) User identity information	Information about users' online or offline identities, roles, behaviors, or resources related to a crisis	Anderson et al. (2015) ; Day et al. (2009) ; Kim et al. (2018) ; Nielsen et al. (2018) ; Shatte et al. (2016) ; Subba and Bui (2017) ; Takahashi et al. (2015) ; White et al. (2008)
(A4) Social network information	Information about users' connections and positions within the information-sharing and communication network in social media	Ahuja et al. (2018) ; Day et al. (2009) ; Getchell and Sellnow (2016) ; Kim et al. (2018) ; Lai et al. (2017) ; Semaan and Mark (2011) ; Tyshchuk et al. (2012) ; Yates and Paquette (2011)
(A5) Sense-making information	Information that helps users interpret and give meaning to crisis events or related activities	Gaspar et al. (2016) ; Heverin and Zach (2012) ; Jong and Dücker (2016) ; Manika et al. (2017) ; Mazer et al. (2015) ; Pang and Ng (2016) ; Simon et al. (2016) ; Vaast et al. (2017)
(A6) Curated information	Crisis-related information that has been pre-processed by users before they contribute or forward it	Kwon et al. (2011) ; Lai and Tang (2018) ; Leong et al. (2015) ; Osatuyi et al. (2012) ; Palen et al. (2007) ; Power and Kibell (2017) ; Rice and Spence (2016) ; Subba and Bui (2010)
(B) Knowledge	Crisis-related information users have obtained through personal familiarity	Brenghar and Mujkic (2016) ; Currion et al. (2007) ; Kaewkitipong et al. (2016) ; Leong et al. (2015) ; Ludwig et al. (2015) ; Majchrzak and More (2011) ; Semaan and Mark (2011) ; Yates and Paquette (2011)
(C) Authority	Users' power to influence others' interpretations or behaviors related to a crisis	Abedin and Babar (2018) ; Carter et al. (2014) ; Jong and Dücker (2016) ; Kim et al. (2018) ; Lachlan et al. (2014a) ; Lin et al. (2016b) ; Subba and Bui (2017) ; Torrey et al. (2007)
(D) Social support	Statements that express informational, emotional, appraisal, or instrumental support, or request or assure corresponding resources in response to a crisis	Ahmed and Sinnappan (2013) ; Gaspar et al. (2016) ; Grabowski and Roberts (2011) ; Heverin and Zach (2012) ; Leong et al. (2015) ; Liu and Xu (2018) ; Nielsen et al. (2018) ; Omilion-Hodges and McClain (2016)
(E) Workforce	Users that undertake activities in response to a crisis	Brenghar and Mujkic (2016) ; Currion et al. (2007) ; Kaewkitipong et al. (2016) ; Lambert (2016) ; Leong et al. (2015) ; Majchrzak and More (2011) ; Radianti et al. (2016) ; Reuter et al. (2014)
(F) Goods and materials	Equipment that can be utilized to respond to a crisis	Brenghar and Mujkic (2016) ; Currion et al. (2007) ; Kaewkitipong et al. (2016) ; Leong et al. (2015) ; Radianti et al. (2016) ; Torrey et al. (2007) ; White et al. (2008) ; Vaast et al. (2017)
(G) Funds	Financial means that can be utilized to respond to a crisis	Brenghar and Mujkic (2016) ; Grabowski and Roberts (2011) ; Nan and Lu (2014) ; Radianti et al. (2016) ; Roshan et al. (2016) ; Subba and Bui (2010) ; Takahashi et al. (2015) ; Qu et al. (2009)

resources and services, such as psychological counseling, sheltering, donations, and volunteer activities (e.g., Currion et al., 2007; Qu et al., 2009; Reuter et al., 2014; Subba and Bui, 2010; Torrey et al., 2007). This also includes organizations using social media to devise and realize joint efforts to respond to crises and promote the activities of other organizations or unaffiliated users (e.g., community response activities or digital volunteer initiatives) to facilitate their acquiring resources for a common purpose (e.g., Kaewkitipong et al., 2016; Radianti et al., 2016; Yates and Paquette, 2011).

Using social media, organizations can furthermore invite non-organizational users to contribute resources to particular crisis response activities; those users can then provide information and knowledge, volunteer to take on tasks, or donate funds (*crowdsourcing contributions*). Organizations can thus use social media to acquire information and other resources provided by non-organizational users who acknowledge and support their purpose to enhance their operational capabilities responding to a crisis, for instance, by validating information obtained from social media and other sources, registering volunteer workforces, collecting funds and materials, and assigning tasks to various organizational and non-organizational responders (e.g., Brengarth and Mujkic, 2016; Kaewkitipong et al., 2016; Mirbabaie et al., 2016; Poblet et al., 2018; Reuter et al., 2014).

In addition, social media can support the emergence of novel organizational actors who are connected through a shared understanding or shared identity, and whose missions, purposes, structures, and boundaries arise from users' repeated interactions enabled by social media (*developing community*). Thus, social media help (re-)establish communication ties between otherwise disconnected users, such as disconnected community members, users with different organizational backgrounds and affiliations, and international audiences (e.g., Pan et al., 2012; Tim et al., 2017; Yates and Paquette, 2011); express inner processes such as feelings and thoughts (e.g., Gaspar et al., 2016; Heverin and Zach, 2012; Neubaum et al., 2014); seek and share social and emotional support (e.g., Leong et al., 2015; Nilsen et al., 2018; Omilion-Hodges and McClain, 2016); and identify opportunities for community action and novel ways of engagement (e.g., Nan and Lu, 2014; Oh et al., 2015; Qu et al., 2009; Vaast et al., 2017). Thus, social media can facilitate identifying novel ways to undertake established tasks, such as distributing information to relevant audiences and co-producing information through social reporting (e.g., Chatfield et al., 2014; Currion et al., 2007; Majchrzak and More, 2011; Maresh-Fuehrer and Smith, 2016), and also determining novel tasks that can be addressed using social media, such as mitigating rumors or restraining incivility and otherwise destructive or violent behavior among community members (e.g., Kaewkitipong, et al. 2016; Subba and Bui, 2012; 2017; Zhao et al., 2016).

Finally, social media allow communities of interacting users to develop, adapt, and enforce commonly accepted standards for their interactions, such as rules of conduct, workflows, and roles for moderating discussions (*establishing norms*). Such norms may emerge

Table 5
Overview of open processes facilitated by social media.

Open processes	Definitions	Selected references
(H) Disseminating	Contributing and forwarding digital content to make crisis-related information and other resources available to users through social media	Abdullah et al. (2017); Chatfield and Brajawidagda (2013; 2014); Choudhary et al. (2012); Kim et al. (2018); Li et al. (2014); Lin et al. (2016a); Tyshchuk et al. (2012)
(I) Social sensing	Accessing digital content contributed to social media to gather or generate resources through further activity	Carter et al. (2014); Drasch et al. (2015); Hong et al. (2018); Ludwig et al. (2015); Pogrebnyakov and Maldonado (2018); Radianti et al. (2016); Veenstra et al. (2014); Wu and Cui (2018)
(J) Social reporting	Accessing digital content contributed to social media specifically with the purpose to be put to use in response to a crisis to gather or generate resources through further activity	Bergstrand and Stenmark (2016); Chatfield et al. (2014); Currion et al. (2007); Majchrzak and More (2011); Maresh-Fuehrer and Smith (2016); Poblet et al. (2018); Reuter et al. (2014); Tim et al. (2017)
(K) Sense-making	Interacting with other users to develop an understanding of crisis events and related resources and activities	Hauser et al. (2017); Heverin and Zach (2012); Jong and Dückers (2016); Mazer et al. (2015); Oh et al. (2013); Oh et al. (2015); Purohit et al. (2013); Vaast et al. (2017)
(L) Gatekeeping	Selecting and filtering crisis-related digital content to be contributed to or forwarded through social media	Abdullah et al. (2017); Carter et al. (2014); Kim (2014); Kim et al. (2018); Kwon et al. (2011); Lai and Tang (2018); Power and Kibell (2017); Rice and Spence (2016)
(M) Translating	Synthesizing and explaining messages conveyed by crisis-related digital content in social media by expressing them in terms that are generally comprehensible	Ahmed and Sinnappan (2013); Carter et al. (2014); Kaewkitipong et al. (2016); Leong et al. (2015); Oh et al. (2013); Subba and Bui (2017); Tim et al. (2017); Yates and Paquette (2011)
(N) Decision-making	Interacting with other users to analyze problems related to crises, identify and evaluate potential solutions, and reach agreement regarding solutions to be implemented	Leong et al. (2015); Liu and Xu (2018); Maresh-Fuehrer and Smith (2016); Nan and Lu (2014); Power and Kibell (2017); Qu et al. (2009); Seeber et al. (2017); Torrey et al. (2007)
(O) Relief coordination	Acquiring and deploying resources according to insights about requests and contributions acquired through social media	Currion et al. (2007); Kaewkitipong et al. (2016); Maresh-Fuehrer and Smith (2016); Meesters et al. (2016); Osatuyi et al. (2012); Ragini et al. (2018); Reuter et al. (2014); Yates and Paquette (2011)
(P) Digital volunteerism	Contributing resources to another organizations' crisis response activities, undertaking related services, or signaling a willingness to do so using social media	Currion et al. (2007); Kaewkitipong et al. (2016); Leong et al. (2015); Majchrzak and More (2011); Meesters et al. (2016); Mirbabaie et al. (2016); Subba and Bui (2012); Torrey et al. (2007)
(Q) Participatory research	Systematically inquiring about crisis response activities while integrating the responses of non-organizational users through social media	Lee et al. (2017); Lin et al. (2016b); Maresh-Fuehrer and Smith (2016); Meesters et al. (2016); Osatuyi et al. (2012); Power and Kibell (2017); Spence et al. (2016); Yates (2016)

from users' repeated interactions or be imposed by organizations or authoritative users; for instance, users may converge towards the use of a particular hashtag or other markers for seeking and sharing information related to a crisis through social activity (e.g., Heverin and Zach, 2012; Lachlan et al., 2014a; Oh et al., 2015), or organizations may ask them to do so to facilitate dissemination (e.g., Abedin and Babar, 2018; Chatfield and Brajawidagda, 2014; Lin et al., 2016b). Similarly, users may identify and report inappropriate content and sanction or encourage others to follow community norms, or group members may adopt the roles of moderators or administrators and take action to enforce rules (e.g., Subba and Bui, 2010; 2012; Torrey et al., 2007).

Review findings on open resources, open processes, and opening effects facilitated by social media

According to our conceptual framework, we assume that the affordances social media provide for internalizing, externalizing, and collaborating affect organizational learning especially through open resources, open processes, and opening effects. Below, we summarize our insights on each aspect of openness and explain how actualizing the affordances provided by social media might help achieve them. We list selected references for each resource, process, and effect in Tables 4–6. Appendix F includes the complete list of matched references.

Findings on open resources

Open resources refer to various means of facilitating crisis management that are made accessible to or that can be used by anyone, or at least an a priori undefined group of people, through social media. Table 4 is an overview of these resources, with definitions and selected references.

Our results suggest that information is a key resource made accessible to users across organizational boundaries through using social media. This information includes *situational information*, such as warnings, updates, or first-hand reports (e.g., Liu and Xu, 2018; Ludwig et al., 2015), *geo-location information*, such as road or place names or geo-location tags (e.g., Abedin and Babar, 2018; Chatfield et al., 2014; Majchrzak and More, 2011), *user identity information*, for instance, users' digital profile information, interaction histories, and other kinds of digital traces (e.g., Lin et al., 2016b; Shatte et al., 2016; Torrey et al., 2007), *social network information*, such as users' contacts, frequency or intensity of interaction, and degree or other centrality within the communication network (e.g., Getchell and Sellnow, 2016; Kim et al., 2018; Lai et al., 2017), *sense-making information*, such as opinions, personal interpretations, and criticism (e.g., Heverin and Zach, 2012; Jong and Dückers, 2016; Vaast et al., 2017), and various forms of pre-processed or *curated information* that has been evaluated, filtered, aggregated, annotated, or combined with other sources of information (e.g., Kwon et al., 2011; Lai and Tang, 2018; Rice and Spence, 2016). Information is transmitted through digital content in various formats, such as text messages and graphical materials, including photos and videos (e.g., Bergstrand and Stenmark, 2016; Carter et al., 2014; Chatfield and Brajawidagda, 2014; Kaewkitipong et al., 2016; Tim et al., 2017).

Beyond mere information, social media facilitate access to *knowledge* that users have acquired through familiarity with aspects of a crisis or crisis management, for instance, through professional activities or prior experiences dealing with a crisis (e.g., Ludwig et al., 2015; Semaan and Mark, 2011; Tim et al., 2017; Yates and Paquette, 2011). Digital content may also convey users' *authority*, that is, their power to influence others' perceptions of or responses to a crisis. Authority may be based on users' offline identities, such as being a member of an emergency response organization, a media representative, or a specialist on some topic, online roles, such as being an influencer or digital volunteer, usage behaviors, such as issuing regular updates, responding to audiences' questions, and engaging in interactive dialogue, and content format criteria, such as using pre-defined formats for warnings and other messages or employing message credibility characteristics (e.g., Abedin and Babar, 2018; Chatfield and Brajawidagda, 2013; Jong and Dückers, 2016; Lachlan et al., 2014a; Lin et al., 2016b; Stewart and Wilson, 2016).

Other resources that can flow through or be made available across organizational boundaries through the use of social media

Table 6
Overview of opening effects enabled by social media.

Opening effects	Definitions	Selected references
(R) Transparency	Accessibility of information pertaining to organizational resources and processes with respect to crisis response	Abedin and Babar (2018); Ahmed and Sinnappan (2013); Getchell and Sellnow (2016); Liu and Xu (2018); Majchrzak and More (2011); Rianti et al. (2016); Roshan et al. (2016); Yates and Paquette (2011)
(S) Interactivity	Reciprocal engagement of organizational and non-organizational users to access and provide crisis-related information and other resources	Abedin and Babar (2018); Ahmed and Sinnappan (2013); Crijns et al. (2017); Jong and Dückers (2016); Kaewkitipong et al. (2016); Ki and Nekmat (2014); Ross et al. (2018); Shatte et al. (2016)
(T) Responsiveness	Timely, appropriate, and sympathetic reactions to non-organizational users' inputs and requests	Brengarth and Mujkic (2016); Lachlan et al. (2014b); Lin et al. (2016b); Liu and Xu (2018); Ludwig et al. (2015); Meesters et al. (2016); Stewart and Wilson (2016); Tim et al. (2017)
(U) Empowerment	Crisis response activities undertaken by non-organizational users independent of organizational resources and processes	Ahed and Sinnappan (2013); Chatfield and Brajawidagda (2013); Fischer (2018); Kaewkitipong et al. (2016); Leong et al. (2015); Majchrzak and More (2011); Semaan and Mark (2011); Tim et al. (2017)
(V) Participation	Involvement of non-organizational users in organizational crisis response	Chatfield et al. (2014); Currión et al. (2007); Liu and Xu (2018); Meesters et al. (2016); Mirbabaie et al. (2016); Osatuyi et al. (2012); Reuter et al. (2014); Seeber et al. (2017)

include *social support*, such as encouragement, sympathies and condolences, expressions of gratitude or relief, community appeals, or provision of relevant services (e.g., Gaspar et al., 2016; Leong et al., 2015; Nilsen et al., 2018; Omilion-Hodges and McClain, 2016), as well as various non-informational resources, in particular, *workforce*, such as employees or volunteers who can be assigned to a task, such as constructing barriers or providing relief (e.g., Brengarth and Mujkic, 2016; Currion et al., 2007; Kaewkitipong et al., 2016; Reuter et al., 2014), *goods and utilities*, such as materials donated by non-organizational users, for instance, tools, food, or clothing (e.g., Brengarth and Mujkic, 2016; Radianti et al., 2016; Vaast et al., 2017; White et al., 2008), and *funds*, such as charity donations (e.g., Grabowski and Roberts, 2011; Qu et al., 2009; Subba and Bui, 2010; Takahashi et al., 2015).

Findings on open processes

Open processes are goal-directed activities to manage crises in which anyone, or at least an a priori undefined group of people, can participate through using social media. Table 5 is an overview of these processes, with definitions and selected references.

Open processes can take place at all levels of organization: individual, group, and organizational. At the individual level, actualizing affordances for externalizing facilitates *disseminating* crisis-related information, which means that social media can complement established channels of risk and crisis communication and facilitate tasks such as informing and educating the public. In particular, social media can help organizations increase the reach and speed of communications (e.g., Abedin and Babar, 2018; Ahmed and Sinnappan, 2013; Kaewkitipong et al., 2016; Power and Kibell 2017; Tim et al., 2017) and involve non-organizational users in forwarding messages (e.g., Abedin and Babar, 2018; Chatfield et al., 2014; Kim, 2014).

In contrast, actualizing affordances for internalizing, organizations can gain access to information and knowledge provided by non-organizational users through *social sensing* and *social reporting*. While social sensing – for instance, through monitoring the information stream – considers such information as passive resource that can be collected and harnessed by organizations, social reporting – for instance, through establishing digital presences to which relevant information can be delivered – allows organizations to involve non-organizational users actively in the co-production and further dissemination of informational resources (Poblet et al., 2018). Thus, organizations may draw on the resources provided by non-organizational users to enhance their own situational awareness and contribute to that of others (e.g., through the interplay of contributing and forwarding information on the one hand, and monitoring the information stream on the other), as well as their ambient awareness (e.g., through identifying relevant users and information providers, establishing connections to them, and integrating the information and other resources provided by them).

At the group level, social media support *sense-making* – as the primary mode of social information processing – and *gatekeeping* processes and also facilitate *translating specific knowledge*. This implies that social media enable users to interact with others to develop an understanding of crisis events and related activities, such as through organizing, relating, and validating information that is available from social media and other sources (e.g., Heverin and Zach, 2012; Jong and Dücker, 2016; Majchrzak and More, 2011), selecting information to disseminate to others (e.g., Abedin and Babar, 2018; Kwon et al., 2011; Lai and Tang, 2018), and explaining their insights to non-organizational users and wider audiences, such as through specific language or content formats, including videos or infographics (e.g., Leong et al., 2015; Tim et al., 2017; Yates and Paquette, 2011). In that regard, actualizing affordances for internalizing and externalizing allows users to collect and disseminate relevant information; however, it is affordances for collaborating – especially for negotiating consensus through repeated interactions – that facilitate convergence towards a shared understanding, which constitutes the basis for the alignment of goals and activities (e.g., Getchell and Sellnow, 2016; Grabowski and Roberts, 2011).

Finally, moving toward the organizational level, social media can help organizations implement specific steps in the *decision-making* process. For instance, they can use social media to crowdsource ideation (e.g., Maresh-Fuehrer and Smith, 2016) or tap users' collective information-processing capabilities to validate information obtained by monitoring the information stream (e.g., Power and Kibell, 2017). Social media not only allow established organizations to facilitate, enrich, or outsource decision-making processes; for emergent organizations – such as associations of community members and digital volunteers – that address established or novel tasks in response to a crisis, social media provide opportunities to identify and discuss opportunities for action, evaluate suggestions, and comment and vote on proposals by actualizing affordances for collaboration (e.g., Leong et al., 2015; Nan and Lu, 2014; Qu et al., 2009).

Beyond that, social media can facilitate *relief coordination*, for instance, through monitoring the information stream to determine opportunities for action, identifying relevant actors and establishing connections to them, acquiring resources, and implementing concerted actions (e.g., Kaewkitipong et al., 2016; Maresh-Fuehrer and Smith, 2016; Reuter et al., 2014). In addition, they can provide opportunities to engage in *digital volunteerism* – for instance, by enabling novel ways of engagement, such as moderating communities, validating and disseminating information, and garnering support for organizational activities (e.g., Chatfield et al., 2014; Kim, 2014; Kwon et al., 2011; Majchrzak and More, 2011; Torrey et al., 2007) – and allow organizations to engage in *participatory research*, through ex-post analysis of digital traces, by facilitating crisis simulations and exercises, by identifying potential study participants, and so on (e.g., Meesters et al., 2016; Osatuyi et al., 2012; Spence et al., 2016). In that regard, affordances for collaborating are again crucial for aligning resource demands and provisions, so that users can request and contribute required information, knowledge, goods, and other resources.

Findings on opening effects

Finally, opening effects are ways in which using social media to open resources and processes can lead to inclusive and participative shifts in the paradigms of organizational learning. Table 6 is an overview of these effects, with definitions and selected references.

Overall, we have identified five potential opening effects. The first is *transparency*, which means that resources and processes organizations employ to respond to crises become visible to non-organizational users, while organizations may learn about resources and processes beyond their boundaries. Informational resources can thus be accessed and utilized directly by actualizing affordances for internalizing (e.g., Ludwig et al., 2015; Radiani et al., 2016), while other resources, such as workforce, goods and utilities, and funds can be acquired by acting upon such information (e.g., Brengarth and Mujkic, 2016; Currion et al., 2007; Kaewkitipong et al., 2016; Leong et al., 2015).

The second opening effect is *interactivity*, which means that organizations can engage in dialogue with non-organizational users, responding to their requests, providing targeted information, and adapting responses to users' behaviors and identities. This implies that using social media facilitates developing a shared understanding across boundaries, shaping non-organizational users' perceptions and responses, and building community with stakeholders (e.g., Abedin and Babar, 2018; Ahmed and Sinnappan, 2013; Ki and Nekmat, 2014; Meng et al., 2016; Ross et al., 2018).

The third effect is *responsiveness*, which – in contrast to transparency and interactivity – captures organizations' reacting to non-organizational users' communications. For instance, organizations may dispatch resources to locations indicated by non-organizational users, clarify conflicting information and resolve rumors reported to them, and involve community actors and digital volunteers in validating and disseminating information (e.g., Ahmed and Sinnappan, 2013; Liu and Xu, 2018; Pogrebnyakov and Maldonado, 2018; Power and Kibell, 2017; Zhou et al., 2013).

The fourth effect we have identified is the *empowerment* of non-organizational users. Using social media, organizations can provide opportunities for non-organizational users to contribute to their efforts to respond to a crisis, such as through crowdsourcing resources (e.g., Brengarth and Mujkic, 2016; Kaewkitipong et al., 2016; Maresh-Fuehrer and Smith, 2016). Beyond that, social media may open novel ways of engagement, especially for individual users and communities. In particular, the literature discusses self-organization of community relief activities that can supplement, or even replace, organizational crisis response (e.g., Leong et al., 2015; Nan and Lu, 2014; Semaan and Mark, 2011).

The final effect we have identified and that is evident from the literature is *participation*, which means that organizations can use social media to involve non-organizational users in organizational crisis response. This effect goes beyond merely repurposing external resources; social media may lead organizations to adapt their structures and routines to involve affected citizens, volunteers, businesses, and other organizations, and approach joint ownership of crisis management. For instance, organizations can use social media to establish and promote coalitions of responders, maintain relational ties to stakeholders that can be activated in case of a crisis, and devise dedicated roles that can be taken by external actors in support of organizational crisis management (e.g., Liu and Xu, 2018; Power and Kibell, 2017; Reuter et al., 2014).

Implications for organizational learning in crisis management: Discussion and research agenda

The goal of our systematic literature review is to consolidate prior contributions of IS research with respect to what they reveal about how social media afford organizational learning in crisis management, especially through providing access to open resources, facilitating open processes, and promoting opening effects. Overall, we have identified and described 15 affordances for internalizing, externalizing, and collaborating that are evident from prior research that contribute to opening organizational learning in the context of crisis events, along with the resources, processes, and effects they might enable. Below, we summarize our insights and outline how actualizing the affordances provided by social media might contribute to opening organizational learning in terms of intuiting, interpreting, integrating, and institutionalizing processes.

Discussion

Following from the conceptual framework, open resources constitute the basis for open processes, which, in turn, facilitate opening effects on organizational learning in crisis management. Strategic implications that affect the underlying paradigms of organizational learning, in turn, can provide further possibilities for opening resources and processes in crisis management for participation across organizational boundaries. Fig. 4 illustrates this process.

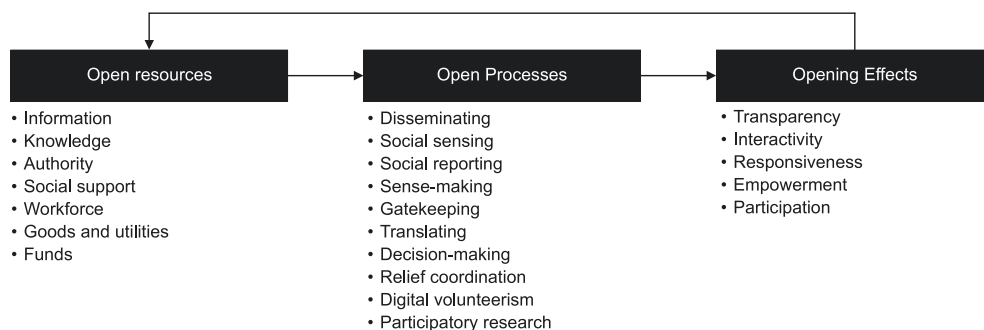


Fig. 4. Summary of open resources and processes and opening effects in organizational learning in crisis management.

Actualizing affordances for internalizing, externalizing, and collaborating allows organizations to access open resources and engage in open processes, and eventually leads to the emergence of opening effects. Table 7 summarizes our insights into how actualizing the identified affordances can contribute to opening organizational learning in crisis management; below, we address prominent research themes for each.

First, in support of *intuiting*, our findings suggest that organizations can benefit from social media through enhancing their own and other users' situational and ambient awareness. Actualizing affordances for externalizing allows organizations to open organizational information and knowledge to non-organizational users and thus increase the transparency of crisis management resources and processes. Research related to this aspect of crisis management typically addresses audiences' information needs (e.g., Hong et al., 2018; Pogrebnyakov and Maldonado, 2018; Ragini et al., 2018; Rudra et al., 2018) and factors that influence the reach and speed of information propagation (e.g., Kim et al., 2018; Oh et al., 2015; Tanaka et al., 2014; Zeng et al., 2016), as well as the effectiveness of organizational communications (e.g., He et al., 2018; Lai and Tang, 2018; Meng et al., 2016; Stieglitz et al., 2018). Factors related to the propagation and persuasive power of organizational crisis communications include, for instance, strategies for signaling credibility (e.g., Lachlan et al., 2014a; Lin et al., 2016b), positioning within the communication networks (e.g., Getchell and Sellnow, 2016; Lai et al., 2017), and message design and channel choice (e.g., Han et al., 2015; Osatuyi et al., 2012).

Furthermore, actualizing affordances for internalizing allows organizations to harness external information and knowledge resources. Papers we have reviewed often address issues related to information overload and approaches to evaluating the relevance and trustworthiness of user-generated content, along with the design of technological artifacts that automate monitoring (e.g., Anderson et al., 2015; Ludwig et al., 2015; Mittelstädt et al., 2015). Other questions addressed in IS research include how users who could make a meaningful contribution can be identified, and how they could be motivated to contribute relevant information and knowledge (e.g.,

Table 7
Summary of review findings.

Organizational learning	Intuiting	Interpreting	Integrating	Institutionalizing
	<ul style="list-style-type: none"> - Social media grant access to external <i>information and knowledge</i> resources. - Harnessing these resources can increase organizational users' <i>situational and ambient awareness</i>. 	<ul style="list-style-type: none"> - Along with crisis-related information and knowledge, digital content can convey its originator's <i>authority</i>. - This provides opportunities for organizations to influence audiences' <i>perceptions of and responses to a crisis</i> and facilitate the emergence of a <i>shared understanding</i> across organizational boundaries. 	<ul style="list-style-type: none"> - Social media enable access to resources that can be used to respond to a crisis, in particular: <i>specific information and knowledge, social support, workforce, goods and utilities, and funds</i>. - Social media can hence enhance organizations' operational crisis response capacities. 	<ul style="list-style-type: none"> - Social media provide access to <i>digital traces</i> from prior events, as well as to information about users who have participated in crisis communications during prior events or exercises. - Access to external resources can inform strategic organizational adaptation and change processes, and hence enhance operational capabilities in response to future crises.
	<ul style="list-style-type: none"> - Affordances for internalizing facilitate resource acquisition through <i>social sensing</i> and <i>social reporting</i>. - Affordances for externalizing provide organizations with an alternative channel for <i>information dissemination</i>. 	<ul style="list-style-type: none"> - Affordances for externalizing facilitate <i>gatekeeping</i> and allow <i>translating specific knowledge</i>. - Affordances for collaborating enable collective <i>sense-making</i> practices. 	<ul style="list-style-type: none"> - Affordances for collaborating support <i>group decision-making</i> and allow organizations to outsource organizational decision-making. - Furthermore, they facilitate <i>coordinated relief provision</i> and allow non-organizational users to identify opportunities for action and engage in <i>digital volunteerism</i>. 	<ul style="list-style-type: none"> - Addressing the requests of non-organizational users can enhance the <i>responsiveness</i> of organizational crisis communications. - Identifying opportunities for action facilitates <i>user and community empowerment</i> in crisis response. - Novel ways of engagement allow for the <i>participation and involvement</i> of non-organizational users in organizational crisis response.
	<ul style="list-style-type: none"> - Availability of and access to information and knowledge resources across and beyond organizational boundaries can increase the <i>transparency</i> of crisis management resources and processes. 	<ul style="list-style-type: none"> - Requesting and providing access to targeted information and knowledge resources contributes to the <i>interactivity</i> of crisis communications. 	<ul style="list-style-type: none"> - Integrating external actors and resources into organizational structures and processes facilitates opening organizational learning in crisis management in response to future crises. 	
	Open resources	Open processes	Opening effects	
Openness				

Chatfield and Brajawidagda, 2014; Ogie et al., 2018; Poblet et al., 2018). While collaborative activities, such as crowdsourcing and establishing connections to stakeholders, are frequently referenced in that regard, they are typically considered avenues for organizations to take as part of their ad-hoc operational crisis response activities (e.g., Bergstrand and Stenmark, 2016; Brengarth and Mujkic, 2016; Kaewkitipong et al., 2016).

Second, with respect to *interpreting*, organizations can use social media to share information that conveys a particular interpretation of a crisis and use their authority to influence non-organizational users' perceptions of and responses to a crisis. Key to this are affordances for externalizing, which allow organizations to apply message frames and forward information and knowledge they approve, and which enable them to tailor messages towards their intended audiences in particular. Related research has addressed the role of non-organizational users as gatekeepers who select, curate, and forward potentially relevant information (e.g., Kwon et al., 2011; Lai and Tang, 2018), as well as how particular content formats, such as videos and infographics, can help translate and explain specific knowledge to non-organizational users (e.g., Leong et al., 2015; Yates and Paquette, 2011). Beyond that, IS researchers have discussed strategies for organizations to build a reputation as trustworthy sources of information and hence increase non-organizational users' compliance with organizational crisis communications (e.g., Lachlan et al., 2014a; Lin et al., 2016b), as well as for framing organizational crisis communications, especially in the context of business failures (e.g., He et al., 2018; Ki and Nekmat, 2014; Meng et al., 2016; Roshan et al., 2016; Stieglitz et al., 2018; Xia, 2013).

Beyond that, affordances for collaborating allow users to interact to establish consensus regarding crisis events, related activities, and implications. In particular, social media enable collective sense-making practices through which users can seek and share information that helps them understand and interpret their environment – for instance, personal opinions, criticism, and relevant situational information. Key to this is the interactivity of social media, which means that users not only can provide information for others to access and use, but also respond and reply to others' statements, clarify conflicting information, and address rumors and misinformation that might be circulating. Prior research has addressed, for instance, how organizations can identify rumors based on users' collective behaviors (e.g., Mondal et al., 2018; Oh et al., 2013) and harness the collective intelligence that is available from non-organizational users' joint efforts to make sense of available information, such as to validate information (e.g., Jong and Dücker, 2016; Leong et al., 2015). Research also suggests that interactivity might help organizations develop community and align perceptions with external audiences (e.g., Crijns et al., 2017; Getchell and Sellnow, 2016; Hauser et al., 2017; Ki and Nekmat, 2014).

Third, for *integrating*, there is considerable research on affordances for collaborating that allow users to identify opportunities for action and collaborate activities and contributions from organizational and non-organizational users. Relevant resources run the gamut from specific information and knowledge needed to accomplish particular tasks to social support (e.g., providing instrumental support), workforce (e.g., volunteers), goods and utilities (e.g., equipment), and funds (e.g., donations) that can be requested and promised through social media. Thus, affordances for collaborating allow organizations to access external resources when providing crisis relief and employ available resources where they are needed, based, for instance, on stakeholders' requests (e.g., Abedin and Babar, 2018; Chatfield et al., 2014; Liu and Xu, 2018; Ludwig et al., 2015). Social media contribute to opening organizational learning in particular through enhanced responsiveness and integrative relief provision and coordination. In that respect, existing research has prominently addressed issues related to crowdsourcing, through which non-organizational users can be accessed to provide goods and services (e.g., Brengarth and Mujkic, 2016; Kaewkitipong et al., 2016) and contribute and disseminate relevant information (e.g., Chatfield et al., 2014; Majchrzak and More, 2011; Tim et al., 2017).

Beyond that, research suggests that social media enable users to identify and realize novel opportunities to participate in crisis response and hence empower non-organizational users and communities. Those can, for instance, use social media to fulfill social functions in a crisis event, such as providing instructional materials (e.g., Semaan and Mark, 2011), or take up activities in social media to engage as digital volunteers, for instance, through aggregating, evaluating, and distributing crisis-related information (e.g., Chatfield et al., 2014; Kim, 2014; Kwon et al., 2011; Mirbabaie et al., 2016). Social media can also facilitate novel forms of collective engagement in response to a crisis (e.g., Nan and Lu, 2014; Vaast et al., 2017).

Finally, for *institutionalizing*, our findings suggest that evaluating crisis response – that is, analyzing patterns of information sharing and communication from past events, designing and evaluating technological artifacts for information collection and collaboration, and using social media to conduct crisis simulations and exercises – should enable organizations to learn from their experiences and implement necessary changes, and open organizational learning, for instance, through facilitating participatory research (e.g., Spence et al., 2016; Stewart and Wilson, 2016). Again, non-organizational users can participate in organizational learning by providing resources – in particular, their personal experiences and interpretations – that can then be incorporated into strategic organizational adaptation.

Beyond that, works such as that of Kaewkitipong et al. (2016) suggest that establishing connections to and building coalitions with non-organizational actors, such as local communities or social media influencers, can allow organizations to gain permanent access to external resources, which means that they might rely on these users' information, knowledge, authority, and other resources to facilitate intra-crisis learning during future events, for instance, by integrating social media into strategic organizational decision-making processes (e.g., Lin et al., 2016b). Thus, establishing open processes within organizational structures and routines – for instance, by adapting operational roles and procedures (e.g., Power and Kibell, 2017; Stewart and Wilson, 2016) – is key for opening organizational learning in crisis management prospectively. Experiences using social media in response to a crisis might then facilitate spillover effects on future opening effects with respect to transparency, interactivity, responsiveness, empowerment, and participation.

Research agenda

Overall, our findings suggest that social media use is typically considered an opportunity for intra-crisis learning, while less is

known about how using social media might increase organizations' operational capacities strategically through inter-crisis learning. Table 8 addresses opportunities for researching strategic issues based on feedback and feedforward relationships between affordances.

First, as for *intuiting*, prior research has prominently investigated how organizations might access external resources – especially situational information and relevant knowledge – through actualizing affordances for internalizing, and making organizational information and knowledge resources available to non-organizational users through affordances for externalizing. With respect to open resources, we might ask, therefore, how relevant resources can be made accessible for organizations to use strategically within internal learning processes, for instance, for evaluating organizational goals, adapting structures and routines, and continuing education of personnel between crises – an issue that has been approached thus far only by Yates (2016). Further, research on how continued engagement to make organizational knowledge and information available to external users can affect learning and adaptation in the external domain, both in the short and the long run – for instance, to increase audiences' preparedness and community resilience – could make a valuable contribution.

Pertaining to open processes, the narrow focus on intuiting for intra-crisis learning impedes a strategic perspective. While other disciplines have long discussed strategies for instance for nonprofit organizations to communicate and socialize with audiences to facilitate access to external resources prospectively (e.g., Lovejoy and Saxton, 2012), only a few papers in IS research address the question of how relevant processes could be perpetuated. Thus, drawing upon collaborative affordances to engage with stakeholders and develop community might allow organizations to harness the contributions of preexisting groups committed to their purposes, such as communities of practice or local communities, as well as emergent actors such as citizen volunteers, and hence gain access to more focused (and therefore more valuable) contributions. Furthermore, research into how affordances for collaborating, such as crowdsourcing, could complement unidirectional processes such as social sensing and reporting, and how organizations could adopt social media strategically to prepare for such avenues before crisis strikes, could shed light on profound organizational changes required to enhance operational intuiting capabilities, for instance, through the adaptation or creation of novel job descriptions, the adaptation of operational guidelines, strategic investment in corresponding technological artifacts, and recruitment and training of

Table 8
Opportunities for strategic research on social media use for organizational learning in crisis management.

Organizational learning	Intuiting	Open resources	Open processes Openness	Opening effects
	<ul style="list-style-type: none"> - How can external information and knowledge resources be made accessible for strategic internal learning processes? - How does opening internal information and knowledge facilitate external learning? 		<ul style="list-style-type: none"> - How can organizations use social media to build community with stakeholders to facilitate social sensing and reporting? - What are the strategic requirements for actualizing collaborative affordances to facilitate access to external resources? 	<ul style="list-style-type: none"> - How can transparency be measured and analyzed? - How does transparency stimulate internal learning?
	<p>Interpreting</p> <ul style="list-style-type: none"> - How can organization use social media to open internal resources for sense-making to non-organizational users? - What styles and formats of digital content afford easy comprehension and understanding for organizational and non-organizational users? 		<ul style="list-style-type: none"> - How can non-organizational users and communities be integrated into organizational crisis communications strategically? - How can non-organizational users be adequately integrated into organizational sense-making processes? 	<ul style="list-style-type: none"> - How does interactivity allow integrating internal and external learning processes? - In what ways do social media enable organizations to access and utilize interactive processes and outcomes ex post?
	<p>Integrating</p> <ul style="list-style-type: none"> - What effects does access to and use of external resources have on the effectiveness and efficiency of relief provision? - How can organizations use social media to secure access to external resources strategically? 		<ul style="list-style-type: none"> - How can organizations use social media to design and implement crowdsourcing processes beyond ad-hoc ideation and co-creation? - How can social media promote inter-organizational collaboration between both established and emergent organizations? 	<ul style="list-style-type: none"> - How can organizations use social media to open internal resources and processes to increase non-organizational users' crisis response capacities strategically? - What organizational structures and activities can be devised to integrate non-organizational users with varying degrees of engagement and commitment?
	<p>Institutionalizing</p> <ul style="list-style-type: none"> - What further resources can support strategic organizational learning from prior uses of social media in response to crises? - How do social media afford identifying and accessing relevant resources in a strategic perspective? 		<ul style="list-style-type: none"> - How do social media affordances for operational crisis response complement internal learning processes in established organizations? - How can operational affordances be perpetuated so as to advance organizational learning and development in emergent organizations? 	<ul style="list-style-type: none"> - What are the causal relationships between the identified opening effects? - What are potential further opening effects of using social media for organizational learning in crisis management?

personnel.

Finally, as for opening effects, we argue that that transparency might be treated as the most basic aspect of opening crisis management. In fact, enhanced access to crisis-related information across organizational boundaries is evident from basically all papers we have analyzed. However, we have interpreted transparency broadly, and how exactly transparency should be measured and analyzed is not yet clear; for instance, what information has to be provided by organizations to claim a sufficient level of transparency? Furthermore, existing research does not reveal whether transparency leads to further opening effects and learning. While researchers recommend that organizations fully integrate insights gained through intuiting into the decision-making process (e.g., Lin et al., 2016b), whether they take action in response to social sensing and reporting is rarely discussed. However, further opening effects – especially interactivity and responsiveness, which would signal to non-organizational users that organizations take action and respond to external input – could be contingent upon organizations' succeeding to incorporate insights gained through using social media. We hence argue that IS research would benefit from further insights into how access to external information and knowledge resources translates into actionable learnings.

Second, regarding *interpreting*, the focus of current research is on sense-making – in particular, how social media enable users across organizational boundaries to collaborate to develop a shared understanding, how organizations can tap collective sense-making activities to generate insights, and how they can influence such processes amongst their stakeholders to shape audiences' perceptions and responses in a meaningful way. Most papers thus introduce a distinction between internal and external resources and processes; that is, between information and knowledge resources that reside and take place within and outside the focal organization. This is unfortunate, as it means that the full potential of available information-processing resources remains untapped. In particular, non-organizational users are usually unable to access an organization's internal pool of sense-making information. For instance, community members who attempt to debunk a rumor will typically rely on public information sources, even if emergency response organizations might have access to more substantive information (e.g., Jong and Dückers, 2016; Mazer et al., 2015; Oh et al., 2013).

To unlock the full potential of collaborative sense-making processes, it would hence be advisable to open internal organizational resources to non-organizational users in a more comprehensive way. In addition, the sense-making focus of prior research implies that less insights are available on other aspects of interpreting, in particular, gatekeeping and translating specific knowledge. This lack of insights could negatively affect the effectiveness of organizational communications, as it could imply that their messages are less well understood and less often selected for further propagation by non-organizational users. While the design of organizational communication strategies is not at the heart of IS research, the discipline could help enhance the effectiveness of risk and crisis communications through further insights into how situational information is perceived by organizational and non-organizational users, especially in the context of complex crises characterized by high levels of time pressure, risk, and dynamically changing requirements, and what message and content formats might afford higher levels of comprehension within recipients.

As for open processes, much research – especially in the domain of business and other economic failure crises – adopts a hegemonic focus, with organizational communications as the key determinant of stakeholders' behavior and responses, even if communications are in principle interactive (e.g., Crijns et al., 2017; Ki and Nekmat, 2014). Organizational users are hence seen in the primary position to explain events and provide and translate specific knowledge, while non-organizational users may make secondary contributions, such as forwarding organizational messages (e.g., Abedin and Babar, 2018; Chatfield et al., 2014; Kim, 2014). Organizations might thus forgo opportunities to involve non-organizational users in crisis communications, for instance, as credible advocates for organizational goals and values (e.g., Brengarth and Mujkic, 2016; Hauser et al., 2017). This would require, however, to effectively align internal and external stakeholders' perceptions and understanding of strategic threats to organizational goals. In consequence, further research into how non-organizational users, such as online community members, can participate in organizational sense-making processes to foster their commitment, build community, and enhance their understanding of appropriate communication styles and strategies could make a valuable contribution.

With respect to opening effects, key to the interpreting stage of organizational learning is interactivity. It seems, however, that organizations occasionally consider interactivity as means to placate external stakeholders, such as customers, who voice criticism or express undesirable opinions (e.g., Crijns et al., 2017; Ki and Nekmat, 2014; Roshan et al., 2016). In those cases, we are hesitant to claim opening effects, but instead raise the question of how interactivity could help organizations establish an interface between internal and external learning processes, and hence produce insights that can be fed back into those processes. Furthermore, interactive communications are, by their very nature, highly dynamic and transient. This can make it difficult for organizations to access collaborative processes and outcomes again at a later time; for instance, to generate insights and draw conclusions from collective sense-making processes to enrich intuiting, or to build upon users' shared understanding to advance community or encourage non-organizational users to make further contributions. Based on our review, we call for future research to explore how social media might afford securing the outcomes of interactive communications, for instance, through promoting easily retraceable formats of interaction (e.g., through corresponding conversational norms) or types of social media – for instance, forums or wikis – that offer higher degrees of persistence.

Third, with respect to *integrating*, much IS research has investigated the potentials of social media to identify opportunities for action, and also to enable novel forms of engagement, such as digital volunteerism. Regarding open resources, existing research makes clear that non-organizational users can provide information and knowledge resources directly through social media, while they can promise further resources, such as workforce, materials, and funds, which can then be provided through other means. However, what happens with resources that are hence pledged or provided is less clear; in particular, it would be interesting to learn how deploying external resources can advance or otherwise affect their response. For instance, measurable increases in the effectiveness and efficiency of relief provision have yet to be documented. Such insights could provide valuable to answer the question of whether and under what conditions social media should be adopted in crisis response, which, apart from the work of Kirac et al. (2015), is typically answered

through common-sense and responders' personal evaluations in IS research.

In addition, acquiring external resources is typically considered an avenue for operational crisis response. However, as Day et al. (2009) suggest, it might be useful to employ social media strategically, to identify users who can make a contribution and build commitment even before a crisis. Thus far, we observe attempts to register and monitor volunteer workforces (e.g., Reuter et al., 2014; White et al., 2008) and make contact with social media influencers who might forward organizational messages (e.g., Power and Kibell, 2017); however, much could be gained from an organizational view if the potentials social media provide to identify external resources and secure access to them – for instance, through researching past events, identifying and approaching strategically relevant actors, or building community with relevant stakeholders – were better understood.

For open processes, we find that social media provide two ways to access resources from organizational users: first, through purposive calls for contributions (e.g., through crowdsourcing), and second, through the self-organized coordination of needs and contributions. Our findings suggest that crowdsourcing is currently a theme of major interest among IS researchers. However, likely due to the heavily operational focus of crisis response, calls for participation are typically short-term. For instance, while users may contribute situational information or pledge resources, organizations do not seem to follow up on these contributions, such as allowing users to evaluate ideas or make suggestions for the particular design of a solution. While this is common practice in other domains (e.g., Majchrzak and Malhotra, 2013; Schlagwein and Bjorn-Andersen, 2014), organizations seem to forgo this opportunity when it comes, for instance, to evaluating opportunities for organizational or community engagement, devising instructive materials, or designing technological artifacts for collaborating. Furthermore, discussions thus focus on integrating the contributions made by non-organizational users (e.g., community members) in organizational crisis management. This leaves two gaps: how organizational resources can enhance community response and contribute to community empowerment, and what opportunities social media provide for furthering inter-organizational collaboration. While members of established organizations may rely on existing channels of communication to interact, it is definitely an opportunity for future IS research to investigate how social media can complement and enhance them.

Responsiveness, empowerment, and participation are the opening effects with respect to integrating. The transition between these effects may be floating; for instance, responding to stakeholders' requests may provide them with the resources they need to identify opportunities to contribute to organizational crisis response or devise their activities. Looking beyond the individual crisis, organizations might want to open crisis management even further, such as by providing community members or digital volunteers with resources to build up capacities and connections that can be harnessed during future events, or promoting community structures that increase resilience. At the same time, one might ask how social media could allow non-organizational users to get involved further in organizational crisis management, such as through devising novel models for organizational membership and identifying tasks that can be conducted by unaffiliated responders using social media.

Fourth, *institutionalizing* is the most strategic avenue to organizational learning in crisis management. The results of our review suggest that organizations can use social media to access information about non-organizational users' behaviors during prior events or exercises (e.g., from their digital traces) or learn about their perceptions or responses (e.g., through conducting survey research). However, while researchers have suggested that organizations should utilize their experiences strategically to learn from crises (e.g., Lin et al., 2016b; Stewart and Wilson, 2016), we lack evidence on how organizations might succeed in doing so. In particular, while access to previously contributed digital content is supported by the persistence affordance of social media, evaluating processes ex post could prove difficult, especially if experiences are to be gained from real crises – which usually do not allow for setting up additional mechanisms for recording and transcribing experiences – rather than from simulated events. While it might be possible to reconstruct complex interactions from digital traces, the technical expertise and resources that are necessary to do so cannot be expected to be available within all organizations. Relevant questions are, hence, what further internal and external resources organizations would have to access to learn from past events, and how the affordances social media provide could help them identify and acquire relevant resources. Examples for such resources could be, for instance, other users' or organizations' experiences, technical infrastructure and expertise, and opportunities for practice and training.

As for open processes, we wonder how the affordances we have identified could not only enhance operational crisis management, but furthermore contribute to organizational learning processes. Depending on the organizational context – especially whether organizational learning follows established routines and procedures – those affordances could facilitate internal learning. With regard to emergent organizations that have formed based on the operational uses afforded by social media, the question is how those could succeed in converting these ad-hoc collaborative uses into organizational learning process that facilitate further organizational development.

Finally, regarding opening effects, existing research does not allow for drawing valid conclusions about further steps in opening crisis management, such as joint ownership and other constructs. While much evidence is available regarding effects that result from information sharing and communication – in particular, transparency and interactivity – research on responsiveness, empowerment, and participation is more fragmented. In that regard, it might constitute a promising avenue for future research to evaluate whether the identified opening effects are mutually dependent, thus that hierarchical or other causal relationships might exist among them. Looking further into the future, organizations who have learned for, from, and through using social media in response to crises might be able to unlock further opening effects. IS researchers could pursue such avenues, drawing upon insights into openness in other organizational contexts (e.g., open innovation or open government) to help organizations gain momentum in opening crisis management.

Conclusion

We have presented the results from a systematic literature review that integrates insights from IS research investigating the use of social media in crises. We have summarized the affordances social media provide for the organizational learning process across established organizational boundaries along three classes of affordances for internalizing, externalizing, and collaboration. We discuss how actualizing these affordances can facilitate organizational learning processes – in particular intuiting, interpreting, integrating, and institutionalizing – which allow organizations to access open resources, facilitate open processes through which they can integrate information, knowledge, and other resources provided by non-organizational users, and promote the emergence of opening effects, in particular: transparency, interactivity, responsiveness, empowerment, and participation. Based on our review, we outline directions for future research pertaining to all four processes.

Our review does not come without limitations. Key among them is the literature search and selection process, which was based on keyword-based searches, systematic selection, and forward and backward searches. As we conducted a rather comprehensive and rigorous search, we identified a large number of relevant and peer-reviewed papers, the analysis of which was beyond the limits of manual coding. Our results are based, therefore, on a subset of papers from outlets close to the field of IS research, which means that the generalizability of results is limited to these outlets, just as making claims regarding research gaps is limited. Given that crisis informatics research itself is a heterogeneous field that has emerged from multiple disparate streams and disciplines unified by a shared research interest, alternative approaches based on citation analysis of a limited set of influential core papers, such as suggested by [Larsen et al. \(2019\)](#), are hardly feasible.

Furthermore, our interpretation of prior research is limited in two distinct ways. First, we focused on affordances that can be related to organizational learning enabled by providing access to open resources, facilitating open processes, and promoting opening effects in crisis management. This precludes findings on other aspects regarding social media in crisis management that may be of interest to IS researchers. We are happy to refer readers to previously published review papers that might be of interest (e.g., [Alexander, 2014](#); [Houston et al., 2015](#); [Reuter et al., 2020](#); [Veil et al., 2011](#); [Wukich, 2015](#)). In addition, as we focused on learning processes facilitated by social media, our understanding is necessarily incomplete. Crisis learning is not limited to the realm of social media; actors can learn about crises from other sources as well. Furthermore, we have not discussed the social and cognitive processes that lead users to adopt and subsequently actualize the affordances provided by social media, nor have we discussed the nature of learning beyond organizational boundaries (especially in emergent groups and communities in the public). Nevertheless, we believe our framework can help in understanding how social media might complement existing organizational learning processes from a strategic standpoint.

Our insights can help crisis informatics researchers, especially in the IS community, to integrate their own work into the corpus of knowledge systematically, as we illustrate how the different uses afforded by social media can be related to distinct individual, social, and organizational outcomes. We expect this to be useful in developing a more coherent understanding of what social media can and cannot do when employed to learn for, from, and about crises. Furthermore, it allows us to understand the implications of using social media in crisis management more fully, as we demonstrate how different affordances can work together to enable strategic renewal.

Beyond that, our work illustrates how ICT can be useful to connect seemingly disparate processes to achieve organizational goals. Understanding how organizational behavior and sense-making results in specific organizational outcomes is not trivial ([Maitlis and Christianson, 2014](#)). In particular, we see our main contribution as explaining how ICT usage can contribute to organizational change and the emergence of novel forms of organizing in a real-world context in which understanding the implications of ICT use can save lives and mitigate the impacts of crises. For IS researchers, our insights create opportunities to delve further into the relationship between different affordances, focusing on, for instance, the characteristics and effects of technologically mediated psychological, organizational, and social processes that lead to the emergence and institutionalization of novel forms of organization.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix. Supplementary material

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jsis.2021.101692>.

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