

Review

# Social Networks in Crisis Management: A Literature Review to Address the Criticality of the Challenge

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**Abstract:** This review proposes a concise literature review aimed at identifying the current body of knowledge on the adoption of Social Networks in crisis management. The major input is a structured research question based on the initial reading about the topic. Before the recent pandemic, most literature focused on local crises, with relatively few exceptions. Additionally, self-organising systems are spontaneously established between people who are affected by a crisis. The fundamental assumption underlying this study is the huge potential of Social Networks in the field of crisis management. That is supported, directly or indirectly, by a number of previous studies, which emphasise how effective adoption leads to better decision-making for crisis managers and local communities. Among the identified challenges is the need to integrate official communication by emergency agencies with citizen-generated content in a contest for credibility and trustworthiness. In certain cases, it has been reported that there is a lack of specific competence, knowledge, and expertise, as well as a lack of sufficient policies and guidelines for the use of Social Networks. Those challenges need to be framed by considering the classic difficulties of providing timely and accurate information to deal with fake news, unverified or misleading information, and information overload. Bridging major gaps through advanced analytics and AI-based technology is expected to provide a key contribution to establishing and safely enabling the practice of effective and efficient communication. This technology can help contrast dissonant mental models, which are often fostered by Social Networks, and enable shared situational awareness. Future research may take a closer look at AI technology and its impact on the role of Social Networks in managing crises.



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**Keywords:** social media; social networks; crisis management; mental model; situational awareness; disinformation; misinformation and fake news; infodemic; COVID-19

## 1. Introduction

Despite several different definitions, there is currently no unique universally accepted definition for crisis, which may refer, among others, to disaster, emergency, and catastrophe [1,2]. One definition characterises a defined crisis as an event that has been observed in time and space where societies/communities face physical losses/damages/disruption of their functioning routine. Ref. [3] has classified crises into natural and human-made crises.

Crisis management is commonly understood as the process by which an organisation and/or government deal with an emergency [4,5]. Crisis management is typically approached in four different phases: mitigation, preparedness (prior to a crisis event), response, and recovery [4,5]. The mitigation phase aims to prevent the occurrence of a crisis event as well as mitigate known vulnerabilities inherent within the socioeconomic system. The preparedness phase explicitly targets enabling crisis managers and responders to act effectively [6]. In the response phase, responders act to prevent any further damage from ongoing issues, while during recovery, the focus is on restoring the pre-crisis state [6].

There is a tangible and increasing adoption of Social Media within the specific context of crisis management [7,8]. Indeed, Social Media has become an integral part of commu-

nication during crisis events, enabling the effective real-time dissemination of relevant information [9–11].

Social Media has become an important communication channel for emergency agencies [12,13] to manage crises [14]. Social Networks are used during crises for information gathering [15], situation awareness [16,17], maintaining relationships [18], emotional support [19], volunteer coordination [20,21], disseminating relevant information, and providing advice and guidance [22]. For instance, Social Media was widely beneficial during the flood crisis in Queensland in 2011 [23].

In this research, Social Media is defined within the specific context of crisis management as a socio-technical system that provides real-time information on the crisis and assists in protecting lives and properties [24,25]. Situational awareness is defined as being aware of what events are unfolding around people and gaining an understanding of what potentially relevant information means to them in that specific moment and in the future [26,27]. A significant aspect of situation awareness is the gathering of data from a wide number of sources by crisis managers [28,29].

A mental model is defined as a cognitive model that people use to understand the world [30,31]. A mental model is shaped by various factors, including cultural, environmental, and social factors, as well as people's experiences [31–33]. For instance, people use their personal experiences to develop their own models of understanding the world, which influence their responses [34,35]. A shared mental model is useful in a multi-stakeholder context [35]. Shared mental models are about sharing information, knowledge, concepts, and word usage among individuals to achieve sufficient agreement among stakeholders [36].

In a complex environment, mental models are related to systematic understanding and normally affect decision-making as a determinant of situational awareness [26]. Situation awareness is described as goal-oriented, and a goal–task analysis was used to decide which data the users needed to be aware of. This analysis helps in understanding how the dataset needs to be used in relation to the goal and what projections need to be established to reach these goals [26,37]. Further, situation awareness contributed to 88% of human error as people misunderstood the situation. To avoid these errors, there is a need to develop a higher level of situational awareness [26,37].

The majority of the studies focused on the use of Social Media in crisis management in the United States [38,39], while there are a relatively limited number of studies in other countries or with a more generic focus [40].

Many organisations have invested in incorporating Social Media into their crisis response strategies [41]. It is important to observe how crisis management agencies currently leverage Social Networks to enhance both situational awareness and decision-making. Furthermore, Social Networks are a critical component of any emergency response and preparedness [42]. Government officials have turned to Social Media for various purposes, including information sharing and direct connection with citizens [42].

The Virtual Social Media Working Group (VSMWG) has been established by the US Department of Homeland Security Science and Technology Directorate [42,43], which focuses on providing guidance to emergency agencies on safe practices in using Social Media technologies [42]. There is a general interest in understanding the relationship between Social Media and situational awareness in public safety [42,44]. Many authors emphasise that several organisations have not yet fully understood how to use Social Media to effectively communicate during a crisis [45–50].

Crisis management is a relevant topic that is often the object of review as well as holistic and more specific discussion. This review aims to provide a concise literature review on the adoption of Social Networks in the specific field of crisis management. In this context, Social Networks and Social Media are used indistinctly [51].

Such an analysis aims to frame the challenges within the context of the current body of knowledge. It pointed out a fundamental need for integrating official communication by emergency agencies with citizen-generated content in a context of credibility and trustworthiness. It becomes especially challenging as several sources report a lack of

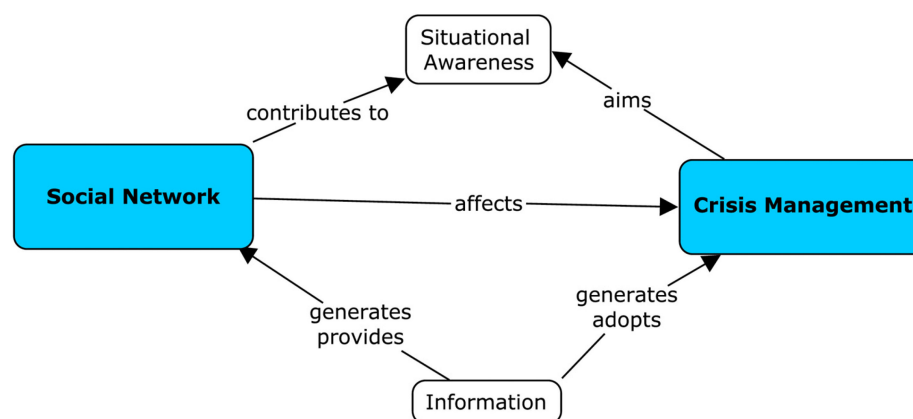
specific competence, knowledge, and expertise, as well as sufficient policies and guidelines. Advanced analytics and AI-based technology provide unprecedented opportunities to establish effective and efficient communication, contrast dissonant mental models, and enable shared situational awareness. It should contribute to the classic difficulties and barriers to providing timely and accurate information, dealing with fake news, unverified or misleading information, and information overload.

This review follows a classic structure, including a discussion of methodological aspects (Section 2), an overview of the review conducted (Section 3), and a discussion of major findings (Section 4).

## 2. Methodology and Approach

This section outlines the methodological approach that has been adopted to provide a concise overview of the impact of Social Media on crisis management. This review has been conducted by following the typical methodological guidelines for performing a systematic literature review in Software Engineering [52].

The topic of the review is summarised by the concept map [53–55] depicted in Figure 1. Such a conceptualisation is further developed and discussed in context as an outcome of the study conducted.



**Figure 1.** Initial conceptual map of the review topic.

That is a conceptualisation of the initial research question: how can better situational awareness be achieved in a crisis management context?

Such a focus has been inspired by previous work [56] on shared situational awareness and COVID-19.

According to the methodology adopted by [52], there is a need to define formal search criteria. This study is mainly based on peer-reviewed papers, and some relevant reports are referenced. They have been retrieved by performing multiple queries based on the combination of significant keywords in the field (“*Crisis Management AND Social Network*”) OR (“*Situational Awareness AND Social Network*”). Data have been retrieved from the most popular databases and repositories (Google Scholar, ACM, ProQuest, and EBSCOhost). A total of 102 documents have been selected to be discussed in this concise review as a result of a critical assessment of their relevance in the context of the target research question, looking at the Title and Abstract. A more extensive analysis based on full text has allowed a reduction to 67 papers, as 35 papers initially selected are considered outside the scope of this research. An additional 36 papers were selected based on snowballing, making a total of 103 papers reviewed in this study.

A PRISMA diagram summarising the process is proposed in Figure 2, while the source of the selected papers is reported in Appendix A. Finally, Appendix B presents a categorisation of the most recent contributions (2018–2022) based on the focus (conceptual, theoretical, or methodological). In the last 5 years, many studies have been conducted at the theoretical level to assist in the development of effective strategies for organisations to

incorporate Social Media in crisis management. It reflects a constantly evolving and more and more consolidated body of knowledge.

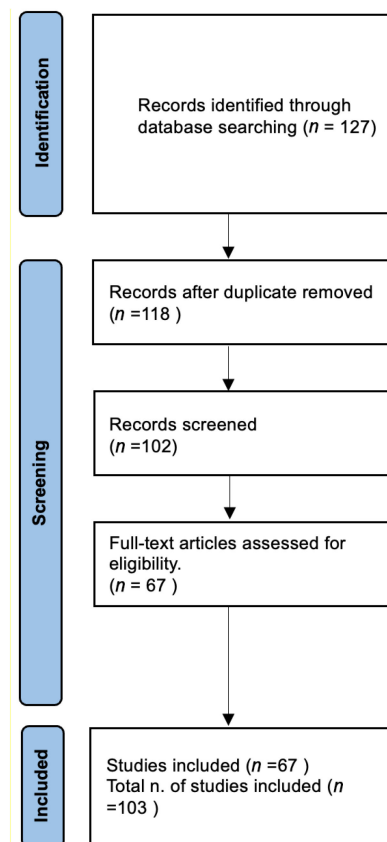


Figure 2. PRISMA Diagram.

### 3. Crisis Management and Social Network

By definition, emergency agencies play an influential and central role during emergency events [57]. The study conducted by [22] has explicitly focused on emergency agencies adopting Social Media, which are extensively used to push critical information, normally according to a one-way channel that does not include any feedback loop [58,59]. Moreover, emergency management agencies have to enable effective and timely decisions to minimise damages [12,60,61].

Emergency agencies find out that the re-sharing feature on Twitter is the key mechanism for expanding the agency's visibility during a crisis [23] within a given community. Therefore, it is necessary for emergency agencies to push re-sharing more during a crisis [22]. Clear sentences with a specific focus have been shown to be especially impactful on the public in terms of dissemination and influence [62].

Online Social Networks have become a significant channel in the context of crisis management, as they have played an important role in assisting people during crises. For instance, Facebook has provided the "I am safe" functionality that allows individuals to inform their connections that they are safe in a given critical situation [63]. Safety checks during a crisis resulted in an effective mechanism to enable Facebook users to notify their contacts list that they are safe [64].

Another clear example in the literature is the early detection of bushfires in Australia, which provides a holistic understanding of the problems facing emergency agencies during bushfires [65]. The data collected from IoT-based forest monitoring sensors [65] combined with data gathered from Social Media are able to provide emergency agencies with a complete picture of the crisis and enhance their knowledge-sharing processes [66,67] and decision-making mechanisms.

Social Networks are recognised as enhancing situational awareness [68]. Recent studies [68] have contributed to consolidating a theoretical link between Social Media and situational awareness [69]. The same study identified Twitter as the most popular platform used during the crisis [50,70].

However, there is a need for further research on the use of Social Media in crisis management to better develop situational awareness [69,71]. Indeed, in some cases, crisis managers are unable to coordinate crisis management strategies due to a lack of situational awareness, which leads to poor decision-making [67,69]. The time and resource constraints push response agencies to make decisions in a continuously changing environment. It requires constant collection, analysis, and sharing of actionable information among the different agencies [72].

### 3.1. The Information Challenge

While many studies have focused on the role of Social Media in improving the dissemination of critical information during crises [73] (e.g., [74]), several contributions [74–77] address the need for further research on disinformation and misinformation, pointing out a relatively limited number of studies on the topic. Indeed, exactly like in everyday life scenarios, Social Media has contributed to the creation and dissemination of false or misleading information [78,79]. That is, of course, the reason for increasing concern [78–81], as such phenomena may become especially critical during a crisis [82]. There are many socioeconomic factors that could hinder communication among Social Media users or generate unwanted patterns [83]. Among others, language barriers [84], lack of trust [85], and different cultural backgrounds [12,86] normally play a relevant role [87].

Ref. [75] examined the fast diffusion of rumours among the public and its consequent impact on decision-making [87]. For instance, consider the case of the earthquake in Ecuador in 2016 [80,81].

In [75,88], the authors have focused on the need for early detection of rumours spread through Social Networks and on the consequent need for a quick response based on verified and updated information. However, it is evidently challenging and expensive, as it requires a highly active presence of emergency agencies on Social Media sites [74,77,89–91].

According to [82], information exchanged via Social Media channels during the crisis and post-crisis presents a generic challenge in terms of trustworthiness and reliability, noted as the most complex challenge yet to be faced [92]. Consequently, emergency agencies must disseminate trustworthy and accurate information as early as possible to address the uncertainty [82]. Such an activity needs to involve experts, government officials, and emergency agency representatives. Overall, this is perceived as a challenge [15,16,93] and contributes to uncertainty and the enormous pressure the decision-makers in crisis face under time constraints [15]. It contributes to perceiving Social Media channels as a threat, inhibiting de facto gain [64].

Among the many suggestions, [94] has proposed AI-based mechanisms to detect, verify, and control rumours on online platforms to prevent the spread of fake news and unverified information [95–97], for instance, through prediction and verification [98].

Another previous work [39] reported a lack of credibility and trustworthiness in citizen-generated content as the main barrier to using Social Media for emergency organisations. Additional possible barriers are a lack of competence, including knowledge and expertise [39], as well as certain internal limitations within organisations, such as appropriate policies and guidelines on the use of Social Media in situations of crisis [99], and a lack of awareness of potential benefits [39]. Emergency agencies normally base their decisions on information that originates from trusted sources and is vetted as credible according to the organisation standards and procedures [24]. That does not normally include ‘The Wisdom of Crowds’ [100].

### 3.2. Managing Information from Social Media

According to a study conducted by [101], the provision of real-time information via Social Media to emergency agencies provides an invaluable opportunity to enhance their overall performance in managing the crisis [102]. In addition, the analysis of Social Media information is used to improve decision-making outcomes [16,102].

However, such an adoption implies several challenges. For instance, agencies are called upon to respond to requests from highly heterogeneous communities [93]. Some studies—[23,62]—have put emphasis on the difficulty of canalising attention to information from authorities' sources, given the large volume of data generated by the public. It led to a need for a shift in thinking to develop expert systems for crises, which are expected to enable dialogical interaction to strengthen management capabilities [39].

Furthermore, there is an intrinsic need to deal with information overload, understood as information produced and presented at a rate too high to be correctly comprehended [103,104]. It creates a pressing need for advanced computational support.

Zhang [105] has explored the impact of corporate social responsibility through the use of Social Media for banking customers in times of crisis [106]. The empirical findings in such a study noted that corporate social responsibility increases customer loyalty in the banking sector [107]. For instance, in Pakistan, a timely proactive approach through Social Media contributed to maintaining customer confidence.

The research conducted by Schroeder [108] focuses on the tourism sector. It identified three major driving factors that influence people to use Social Media [109] in crisis: country of origin, risk perception, and smartphone adoption.

Anastasei's study [106] investigates the serious impacts of word of mouth through Social Networks. Negative comments on products, services, or brands normally lead to difficulties for other group participants in coming to a balanced and unbiased decision.

Wang [110] suggested further research is needed [111] to investigate the role of Social Media in mediating corporate responses to the crisis in the public health context [112] by analysing various communication strategies during the COVID-19 crisis.

Ref. [113] illustrates how companies deal with online complaints over Social Media platforms. On some occasions, issues may escalate to major virality, putting the reputation of the organisation at risk. A proper response can contrast such a trend.

The gap identified by Langaro [113] noted that crisis response strategies are not yet fully investigated in the literature.

### 3.3. Situational Awareness

Various studies emphasise that organisations still do not fully understand how to communicate crisis information using Social Media [45,46,49]. This lack of understanding can lead to compromising the organisation's competitive position and reputation [114]. The research conducted by [114] focuses on the increase in organisations' situational awareness to enable the organisation to gain a better understanding of how it communicates crisis information to different stakeholders.

According to [39], Social Media contribute significantly to establishing situational awareness, building social capital, and allowing direct, rapid, and wide communication with citizens and other agencies. Ref. [39] suggests that more research is needed to study the practices of dissemination of knowledge that contribute to situational awareness [115].

Crisis managers often have to deal with a high volume of information from different sources in order to maintain good situational awareness [116]. The study in [117] points out that decision-makers' performance declines with the increase in the information load to be processed under time constraints.

Research clearly shows the role of Social Media in enabling emergency responders, media outlets, and public health officials to communicate directly with the public [118–120]. In cases of acute public health crises, Social Media may play a central role in quickly disseminating information to the public on a large scale [29,79]. For instance, in 2009, the Alexandria Virginia Health Department effectively used Twitter to direct people to the

vaccination sites during the H1N1 outbreak [121]. Also, research shows the extensive use of Social Media during the Ebola outbreak in West Africa [122,123].

Twitter is the most used platform [70], often adopted to detect and spread the most critical information in an efficient and accurate way to support situational awareness [70]. The public often shares useful real-time information in the affected areas, offers assistance to others, and requests assistance from others [11]. In general, Social Media enables the two-way provision of information [22].

In general terms, Social Media provide solid support for communication [41,119], as shown in several situations. For instance, during the Hurricane Sandy period in 2012 [124], there were more than 20 million tweets sent [125,126]. During the 2011 flood in Thailand, information through traditional channels was slow and ambiguous, while Social Media established a more consistent and reliable two-way communication system [127].

Ref. [39] focuses on the potential of Social Media to facilitate citizen interactions [128] and “help citizens to help others,” with the potential to establish consistent self-organising systems.

Consistent management of the crisis is related to people’s mental models that involve the biases, experiences, beliefs, and values of individuals [33,129]. Mental models are always subject to change in any dynamic environment [130] and play a critical role in decision-making.

### 3.4. Crisis Management, Decision-Making, and Technology

The main function of emergency agencies during a crisis is to enhance situational awareness and inform the public so they can make informed decisions to increase overall safety outcomes [131–133]. Normally, the decision-making processes occur within a multi-agency team in a crisis management context [134].

There is relatively limited guidance in the literature to enable crisis managers to select appropriate crisis response strategies [114], and crisis communication theories do not fully address Social Media [114]. A study reported in [114] adopted a qualitative approach to analyse multiple organisations’ use of Social Media in crisis [135]. Situational Crisis Communication Theory (SCCT) [135,136] has been used as a lens to analyse Facebook posts and tweets [114]. Such generic-purpose platforms are also the most popular in situations of crisis in several countries, for instance, Australia [136,137]. The study pointed out a potential [72] not fully exploited and a number of risks—i.e., for the reputation of a given organisation for not being able to fully address issues on online platforms [114].

Social Networks are expected to play a relevant role in the current and next generations of systems for crisis management [138]. However, to the best of our current knowledge, there is no exhaustive and well-defined analysis of the potential impact of cutting-edge technology, especially AI, to define the next generation of systems, which is expected to be extremely sophisticated. Such potential is addressed in many different contributions, but the big picture is somehow missed. For instance, social bots have recently gained some popularity because of their potential to automate alerts and messages from emergency agencies [93,139–141]. Current research shows promising results when social bots are used retrospectively [93].

While it is implicitly assumed that most modern communication relies on Social Media, emergency agencies need to take specific steps to address rumours and non-accurate information. Advanced analytics [19] and AI-based technology [142] are expected to provide a key contribution to establishing and safely enabling effective and efficient communication in practice.

### 3.5. Datasets

As part of the analysis conducted, we provide an overview of available resources in terms of datasets. Such an overview is not expected to be exhaustive but rather aims to express ongoing efforts to establish solid ground in the field.

Among the many available datasets on the occurrence, impact, and management of natural disasters or related crises, we mention:

- *Global Disaster Alert and Coordination System (GDACS)* [143,144] contains real-time information about natural disasters, including earthquakes, hurricanes, and floods.
- *National Oceanic and Atmospheric Administration (NOAA)* [144,145] on severe weather events, such as tornadoes, thunderstorms, and hailstorms.
- *Emergency Events Database (EM-DAT)* [146] on mass disasters.
- *US Federal Emergency Management Agency (FEMA)* on federal disaster declarations in the United States [147]
- *Global Historical Climatology Network (GHCN)* [148] uses historical weather data, which can be used to study trends in temperature, precipitation, and other climate variables.
- *Sentinel-1* [149] *Radar Imagery*, which provides radar imagery of the Earth’s surface.
- *Global Forest Watch Fires* on wildfires worldwide [150].

In addition, the following datasets are tailored for Social Media related to natural disasters:

- *CrisisLex* [151,152] includes Social Media data related to natural disasters, such as tweets, images, and videos, as well as annotations related to the type of crisis and the type of information shared.
- *CrisisNLP* [153] includes Social Media data related to natural disasters, enriched by annotations and metadata.
- *Twitter Crisis Response Data* [154] include tweets related to natural disasters enriched by annotations and metadata.

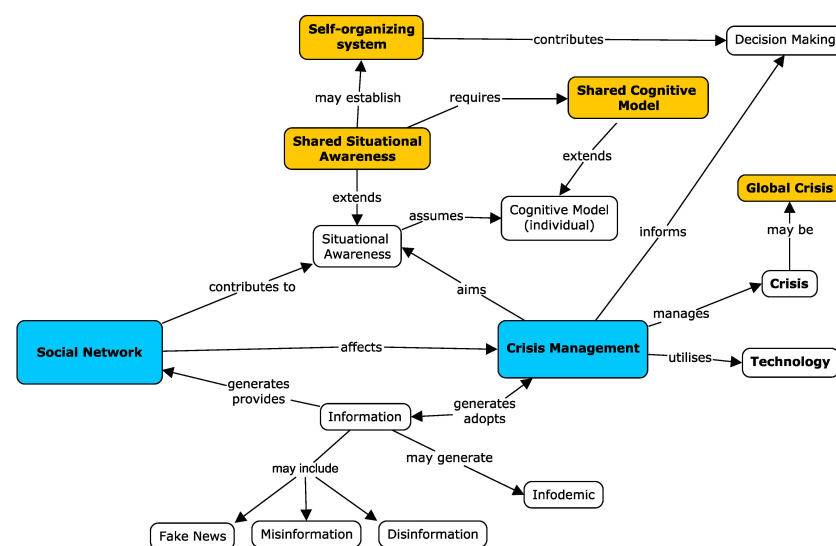
Advanced technological approaches, such as machine learning and Social Network Analysis, have become vital to enforcing sustainable crisis management [50].

#### 4. Results

The analysis conducted has been elaborated and consolidated to (i) conceptualise the state-of-the-art and outline possible future research [155], (ii) identify related gaps and major challenges, and (iii) extend the initial research question to establish a more structured approach. Those outcomes are presented separately in the following subsections:

##### 4.1. Conceptualisation of the Literature Review

A conceptualisation of the analysis conducted is proposed in Figure 3. The identified concepts are not the outcome of a systematic process but, rather, the result of a critical analysis of major gaps and challenges (Table 1), with emphasis on the knowledge generated by this concise literature review.



**Figure 3.** Conceptualisation of the literature review. The root concepts are reported in blue, while the added value of the paper is expressed by the concepts in orange; finally, the concepts in white are understood as already consolidated within the body of knowledge.



**Table 1.** Research Gaps.

	<b>Research Gap</b>	<b>Concept</b>
G1	The capability to systematically retrieve information in real-time as well as generate effective analytics and predictive models is still a challenge [19].	<i>Information retrieval/analysis, analytics, and predictive models</i>
G2	There is no exhaustive and well-defined analysis of the potential impact of cutting-edge technology, especially AI, to define the next generation of systems [142].	<i>Cutting-edge technology, AI, and next-generation systems</i>
G3	Advanced analytics and AI-based technology are expected to provide a key contribution to establishing and safely enabling effective and efficient communication in practice [19,142].	<i>Advanced analytics, AI</i>
G4	The well-known effect of Social Networks on disinformation, misinformation, and fake news has an evident and potentially higher impact on mental and cognitive models in exceptional situations such as crises. Such aspects are currently the object of study [56,79].	<i>Mental model, cognitive model, misleading information, fake news</i>
G5	Dissonant mental models are often fostered by social networks at different levels (e.g., algorithms, influencers), which together undermine social cohesion and form barriers to shared situational awareness. To support effective crisis management, there is a need to establish an alignment of mental models and shared situational awareness, which is evidently a challenge [56,156].	<i>Dissonant mental model, influencer, shared situational awareness</i>
G6	In general terms, there is an intrinsic need to detect and properly deal with rumours and fake news. It becomes more and more critical and relevant in crisis management [94,96,98].	<i>Rumours</i>
G7	There is a general lack of trust and effectiveness across mechanisms that strongly rely on Social Networks, and the recent COVID-19 ‘infodemic’ is a clear example [56].	<i>Trust, infodemic, global crisis</i>
G8	The COVID-19 pandemic has unfortunately provided a kind of stress test for our system. Lessons and, more generally, the experience and knowledge we are developing from the global crisis have not yet been fully translated into tangible general frameworks [56].	<i>Knowledge management and global crisis</i>
G9	Managing a global crisis (e.g., a pandemic) is a complex process that involves many stakeholders to be effective. Shared situation awareness through some mental models of alignment may play a critical role [56].	<i>Global crisis and shared situation awareness</i>
G10	There is relatively limited knowledge about the public-to-public interaction during the crisis and the impact of this self-organising system [22,82,157].	<i>Self-organising system</i>

As extensively discussed, the generic potential role of Social Networks in the context of crisis management is well established and largely accepted [128]. The literature review provided a lot of evidence that supports the establishment of the well-researched area of crisis management and Social Networks and how Social Networks affect crisis management. However, the notions of a self-organising system, shared situation awareness, and a shared cognitive model are still under investigation in the literature. Those three emerging concepts that you can see at the top of the conceptual map diagram are identified in this study as research gaps that need further investigation.

There is an increase in the use of Social Networks in such a context, mostly aimed at situational awareness [158]. At the same time, many studies have noted that organisations are not always able to exploit the potentiality of Social Media [45,46,49,123].

While Social Media are recognised for contributing to situational awareness enhancement during crises [68,70], they may also contribute to generating and propagating fake news, as well as, more generally, misleading information [16]. In this context, the relationship between cognitive load theory and misinformation [159] may play a key role, as people need to understand new information in a very short period of time and eventually make decisions and act accordingly [160]. The key issue is the establishment of shared situational awareness to enable self-organising systems to further enhance decision-making [15,132].

Overall, the evolution of crisis management largely depends on the effective adoption of technology [137]. Cutting-edge solutions based on IoT [65] and AI [161], both with the capability to manage large amounts of heterogeneous data (e.g., from Social Media, geospatial, crowdsourcing, and sensors), are progressively enabling more capable strategies that assume more and more consistent technological support (e.g., social bots [93,140,141]).

#### 4.2. Gap Identification and Challenges

Many challenges have been identified. They are mostly related to:

- Large volume of information exchanged via Social Media [82]
- Uncertainty caused by the lack of reliable and trustworthy information [82]
- User-generated content that does not meet the trust standards of the emergency agencies [16]
- Lack of credibility and trustworthiness in citizen-generated content [39]
- Lack of competence and knowledge expertise [39]
- Lack of sufficient policies and guidelines for the use of Social Media [39]
- Fake news and unreliable information [78,79,95]
- Information overload [104]
- Lack of ability to provide timely and accurate information [162]
- Lack of expertise in building self-organising systems using Social Media [39]
- Fast diffusion of rumours among the public and its negative impact on the decision-making of the public [75,88]

These challenges need to be considered in context, looking at potential mitigator factors such as “crowd wisdom” and self-organised groups [100]. A proper and effective use of Social Media is expected to enhance the system in that direction [163]. On the other side, as in everyday life scenarios, Social Media contributes to creating and disseminating false or misleading information [78,79]. There is reason to be even more concerned [71,78–81,164], as the misinformation through Social Media may become especially critical during a crisis [82].

To the best of our current knowledge, there is no exhaustive and well-defined analysis of the potential impact of cutting-edge technology, especially AI, to define the next generation of systems, which is expected to be extremely sophisticated. Such potential is addressed in many different contributions, but the big picture is somehow missed. For instance, social bots have recently gained some popularity because of their potential to automate alerts and messages from emergency agencies [93]. Current research shows promising results when social bots are used retrospectively [93].

The COVID-19 pandemic has shown additional concerning patterns as disinformation and misinformation switched from a local to a global context, generating an “infodemic” [165].

Consolidated research gaps and the associated concepts are reported in Table 1. These concepts have been integrated into the conceptual map diagram (Figure 3).

#### 4.3. Research Questions

A large number of research questions may be generated by looking at the gaps and challenges previously discussed. Based on the conceptual analysis conducted, the initial research question has been elaborated and structured into two main generic research questions and a number of associated sub-questions (Table 2). The main questions reflect research mainstreams from a holistic perspective, while sub-questions define more specific research lines.

**Table 2.** Structured research questions resulting from the conceptual analysis conducted.

	<b>Research Questions</b>
<b>RQ1</b>	<b><i>How can better shared situational awareness be achieved in a crisis management context?</i></b>
RQ1/a	<i>How can the use of Social Media and AI-based technology change cognitive models to develop shared situational awareness during crises?</i>
RQ1/b	<i>How can we establish alignment between individual cognitive models and shared situational awareness to support effective crisis management? [56]</i>
RQ1/c	<i>What is the expected role of cutting-edge technology in the next generation of systems?</i>
<b>RQ2/</b>	<b><i>How can effective cognitive models be established during a global crisis?</i></b>
RQ2/a	<i>What are the negative aspects of using social networks in the context of the infodemic?</i>
RQ2/b	<i>How did the public interact during the global crisis in terms of information-seeking and self-organisation?</i>
RQ2/c	<i>How can shared mental models be established in a global crisis?</i>

## 5. Conclusions

The purpose of this study is to identify the body of knowledge related to the nexus of crisis management and Social Networks by adopting a multi-perspective approach involving crisis managers, communication experts, and social network analysts.

This review indicates a potentially critical role for Social Networks in a context of crisis, as demonstrated by a tangible and measurable increase in their adoption in real-world situations, including local and global crises. Crisis managers tend to incorporate Social Networks into situational awareness strategies, as they have been critical in assisting crisis agencies in formulating preparedness, recovery, and response efforts. However, while the use of Social Media is assumed to be a consolidated practice, its effective and efficient use in different crisis situations is still considered a challenge.

Situational awareness is a central concept that needs to be understood in context, looking at a fluid and continuously changing environment in which information, misinformation, and fake news are likely to co-exist. There are currently a relatively limited number of studies to assess the relationship between relevant situational awareness and cognitive models, as well as the key factors necessary to effectively establish shared situational awareness. Last but not least, the strong inequality still existing among the different countries [166] may be a serious discriminator as real capabilities may significantly differ from country to country.

The main limitation of this study is related to the intrinsic complexity and multi-disciplinarity of the topic, which require, at the same time, a socio-technical holistic picture and a fine-grained understanding of the different social and technological aspects. We prioritised conciseness and critical analysis, as well as qualitative conceptualisation over systematicity. We believe that our approach has allowed a more focused and framed contribution within a broad discipline with enormous implications in real-world scenarios.

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## Appendix A

**Table A1.** Literature Review Sources.

Source	Selected Papers
<i>Annual Review of Sociology</i>	[2]
<i>Disaster Prevention and Management: An International Journal</i>	[3]
<i>Public Administration Review</i>	[4]
<i>International Conference on Information Fusion</i>	[8]
<i>International Conference on System Safety, Incorporating the Cyber Security Conference</i>	[9]
<i>European Conference Information System</i>	[12]
<i>Information Systems for Crisis Response And Management</i>	[13,59]
<i>Journal of Applied Communication Research</i>	[18]
<i>IEEE International Conference on Technologies for Homeland Security</i>	[20]
<i>Information System Frontiers</i>	[22,86,167]
<i>Journal of Homeland Security and Emergency Management</i>	[24]
<i>Public Relations Review</i>	[41]
<i>Journal of Contingencies and Crisis Management</i>	[45]
<i>International Journal of Strategic Communication</i>	[46]
<i>International Journal of Information Management</i>	[69,161]
<i>Computers in Human Behavior</i>	[168]
<i>European Journal of Information Systems</i>	[159]
<i>Working Conference on Information Systems and Organisations</i>	[57]
<i>IEEE Internet of Things Journal</i>	[65]
<i>Australasian Journal of Information Systems</i>	[66,140]
<i>Disaster Medicine and Public Health Preparedness</i>	[72,74]
<i>Natural Hazards</i>	[75]
<i>Journal of Public Health Management and Practice</i>	[76,77]
<i>Journal of Contingencies and Crisis Management</i>	[91]
<i>Workshop on Social Media Analytics</i>	[80]
<i>International Conference on eDemocracy &amp; eGovernment</i>	[81]
<i>Online Social Networks and Media</i>	[94,96]
<i>Journal of Economic Perspectives</i>	[95]
<i>International Workshop on Semantic Evaluation</i>	[98]
<i>IEEE International Conference on Technologies for Homeland Security</i>	[78]
<i>Social Science Computer Review</i>	[79]
<i>MIS Quarterly</i>	[83]
<i>Disaster Prevention and Management: An International Journal</i>	[84]
<i>Communication of the ACM</i>	[85]

**Table A1.** *Cont.*

Source	Selected Papers
<i>Human Technology</i>	[39]
<i>International Conference on Web and Social Media</i>	[104]
<i>International Journal of Data Science</i>	[101]
<i>Learning and Performance Quarterly</i>	[130]
<i>The Journal of the System Dynamics Society</i>	[129]
<i>International Journal of Human Resources Development and Management</i>	[117]
<i>Safety Science</i>	[116]
<i>Conference on Human Factors in Computing Systems</i>	[118]
<i>New England Journal of Medicine</i>	[121]
<i>IEEE International Conference on Smart Computing</i>	[11]
<i>Technological Forecasting and Social Change</i>	[162]
<i>Computers and Human Behavior</i>	[124]
<i>Hawaii International Conference on System Sciences</i>	[126]
<i>Journal of Decision Systems</i>	[132]
<i>International Journal of Emergency Management</i>	[134]
<i>Management Communication Quarterly</i>	[136]
<i>Journal of the Association for Information Science and Technology</i>	[139]
<i>Industrial Marketing Management</i>	[142]
<i>Global Health: Science and Practice</i>	[169]
<i>Sustainability</i>	[50,166]
<i>Journal of Management Education</i>	[170]
<i>Journal of Decision System</i>	[132]
<i>Information Systems Frontiers</i>	[164]
<i>International Conference on World Wide Web</i>	[19]
<i>International Journal of Information Management</i>	[56]
<i>Philosophy &amp; Technology</i>	[156]

## Appendix B

**Table A2.** Literature Review Classification (2018–2022).

Paper	Year	Contribution	Rational
[50]	2022	Methodological	Use of advanced technological approaches such as machine learning and social network analysis in crisis management.
[65]	2022	Methodological	A machine learning-based approach to detect anomalies in spatiotemporal measurements of environmental parameters to predict bushfires.
[22]	2021	Methodological	Theoretical background on the concept of digital nudging.
[161]	2021	Theoretical Methodological	The notion of a Disaster City Digital Twin is examined, as is how to employ AI in disaster management.
[167]	2020	Methodological	The relationship between Social Media data and the outcome of public events (the Eurovision Song Contest) is investigated.
[159]	2020	Theoretical	Literature review on misinformation and how Social Media contributes to fake news.

Table A2. Cont.

Paper	Year	Contribution	Rational
[74]	2020	Methodological	A systematic review of the use of Social Media during natural disasters and emergency events.
[142]	2020	Conceptual Theoretical Methodological	Artificial intelligence in detecting crises related to events in a firm is discussed, as is how this can lead to efficient crisis management. The paper extends the situational crisis communication theory (SCCT) and attribution theory frameworks.
[56]	2020		Impact of digital disruption on mental model alignment and shared situational awareness.
[70]	2020	Methodological	A literature review on extracting Social Media data and classification schemas to assess situational awareness in events involving natural hazards.
[82]	2020	Theoretical Methodological	A literature review focusing on sense-making and Social Media communication.
[76]	2019	Methodological	Social Networks to address response and recovery strategies for rainfall and flooding in South Carolina in 2015.
[94]	2019	Theoretical Methodological	A multidisciplinary viewpoint on the spread of rumours on online social networks.
[96]	2019	Methodological	A neural network model for classifying online rumours as true, false, or unverified.
[98]	2019	Methodological	Automated claim validation and rumour verification.
[11]	2019	Methodological	Relevancy classification of Social Media posts.
[156]	2019	Conceptual	The value of decisional privacy is explored.
[93]	2019	Conceptual Methodological	Social bots during natural disasters.
[13]	2018	Methodological	Analysis of the behaviour of Twitter users during the 2017 Iran–Iraq earthquake.
[17]	2018	Methodological	Sense-making activities during crisis situations on Twitter.
[69]	2018	Theoretical	Social Media and situational awareness.
[91]	2018	Theoretical Methodological	In-depth analysis of the use of Social Media platforms during the 2013 floods in Dresden, Germany.
[79]	2018	Methodological	Adoption of Twitter data during the Zika virus outbreak in the United States.
[164]	2018	Methodological	A probabilistic model for early detection of rumours in post-disaster scenarios.
[60]	2018	Methodological	Extreme weather in Norway and Social Media.
[61]	2018	Conceptual	Overview of the use and future directions of Social Media in emergency situations.
[62]	2018	Methodological	Communication strategies of emergency agencies during crises on Facebook.
[141]	2018	Methodological	Analysis of tweets during a crisis and the influence of social bots.
[71]	2018	Conceptual Theoretical Methodological	Critical discussion of the role of Social Media.

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