A Consolidated Understanding of Disaster Community Technologies

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ABSTRACT

Since the beginning of this millennium, there has been an increasing use of social media and crowdsourcing (SMCS) technologies in disaster situations (Reuter & Kaufhold, 2018). Disaster management organizations and corresponding research are increasingly working on ways of integrating SMCS into the processes of crisis management. In a changing technological landscape to address disasters, and with increasing diversity of stakeholders in disasters, the purpose of this research is to provide an overview of technologies for SMCS within disasters to improve community resilience. The identified and analyzed technologies are summarized under the term "Disaster Community Technologies" (DCT). The paper presents a classification schema (the "DCT-schema") for those technologies. The goal is to generate an overview of DCT in a rapidly evolving environment and to provide the practical benefit for different stakeholders to identify the right one from the overview.

Keywords

Disaster community technologies, social media and crowdsourcing, categorization and classification schema, knowledge base.

INTRODUCTION

The increasing availability of the internet worldwide and the associated increase in the number of users has led to a growing availability of large amounts of data. A significant part is produced by user interactions in social networks. Social media and crowdsourcing (SMCS) has become an important part of people's daily lives, allowing them to communicate and collaborate in ways never before possible. This new and easily accessible data has become the subject and resource for a variety disciplines that seek to explain and/or understand the functionality of society (Deborah et al., 2019).

The available information on and through social media networks has a continuously increasing importance in disaster situations and therefore also for disaster management organizations (DMO) (Mauroner & Heudorfer, 2016). The access, analysis and use of these disaster related information is realized via Disaster Community Technologies (DCT), which is defined as follows: A DCT is a software(-function) for interaction with, within or among groups of people who have similar interests or have common attributes (communities) in case of a disaster as well as performing analysis of these interactions.

An exemplary benefit of a DCT from a DMO perspective is the rapid dissemination of information to the citizens about the current situation of a crisis. When people are in distress, the need of communication increases and citizens try to contact family and friends and seek "information regarding food, shelter and transportation" (Velev & Zlateva, 2012). Also warning of dangers or instructing actions to build and support resilience are important

measures of disaster management. SMCS have rapidly gained recognition in recent years as an important source of information in disaster situations (Schimak et al., 2015). Consequently, another important benefit of DCT is to increase situational awareness to better assess disaster situations (Trilateral Research & Consulting, 2015).

Certainly, some of the advantages mentioned can also be achieved with a well-managed social media account. Nevertheless, a DCT goes beyond the possibilities of simple social media use. Through the use of complex algorithms and machine learning techniques, DCT allow the analysis and (in part) evaluation of large amounts of data in real time. In their simplest form, they allow the targeting and control of multiple social media channels for information dissemination. More complex functions include, the (meta-)analysis or classification of user-generated content, in order, for example, to capture the sentiment of users on a certain topic. Other important functions of DCT include the involvement and coordination of first responders and volunteers (e.g. Ready2Help[1]) or the use of crowdsourcing applications (e.g. crisis mapping in a flood scenario). In a collaborative crisis map, for example, citizens can enter damage reports on a map and thus help to distribute relief supplies and aid forces more appropriately (Associated Programme on Flood Management, 2017). Further, the widespread use of smartphones among the population makes it possible to use the built-in sensor technology for early detection of earthquakes (Steed, et al., 2019) or a regional damage situation can be recognized at an early stage through disproportionate Twitter activity (Bosca & Bielski, 2018).

Considering the technological aspects as well as the social component it becomes obvious that the effective use of DCT is a multidisciplinary field of research with elements from computer science and social science. However, there is still much to be done in the structured use of DCT by DMO and citizens alike. DMO face major challenges in the use of DCT. The prerequisite and basis for the implementation of DCT into disaster management processes is the handling of data produced in social networks. But the sheer volume of data produced daily (Kaufhold et al., 2019) and the abundance of misinformation (Kadam & Atre, 2020) available on these platforms make it an almost insurmountable challenge to identify relevant information without the right tools. There are already many systems, tools, and algorithms available that can analyze 'big data'[2] in social media (Batrinca & Treleaven, 2014) but a structured overview and categorization of these technologies is still lacking. However, the identification of suitable tools is an important requirement for DMO to be able to work effectively in the field.

In order to contribute to the problem of selecting the adequate technology, this paper presents a first draft of a classification schema, the DCT-schema.

They were either developed specifically for disasters or can be used for the purpose of DMO. The DCT-schema enables the classification and comparison of DCT based on a comprehensive set of categories. Features such as the functional scope of the DCT as well as technical requirements (e.g. interfaces for integration into third-party applications or the handling of metadata) were taken into account. The aim is to make the information available to a wide range of stakeholders, from practitioners, researchers, business sector and policy makers (not limited to this list), with the scope and content of knowledge varying according to the needs of the target groups.

The aim of this paper is to explain the derivation and elaboration of the DCT topic in detail. To this end, the theoretical and methodological foundations are explained below. Based on the results of the analysis, the creation of the DCT-schema is explained.

RESEARCH APPROACH

This section describes the research design for the paper as well as for the draft DCT-schema. To obtain a research overview of relevant DCT, a twofold approach was taken: A literature review and a thorough business market analysis.

The literature review is the starting point of the process. The primary goal was to create a preliminary list of existing DCT and their functionalities. In addition, the literature review resulted in a collection of practical examples and relevant guidelines for the use of SMCS. The scientific literature was collected by searches in Google, Google scholar, academic databases (Springer, ResearchGate and Wiley), and through relevant H2020-, and FP7-projects by using relevant keywords of the SMCS domain combined with specific keywords for the corresponding subtopics (see Table 1 below). The time frame for the search was not limited but focused mainly on literature from the last ten years, as technological developments are fast moving, and information becomes

[1] https://www.rodekruis.nl/hulp-in-nederland/ready2help/

[2] Big data is high-volume, high-velocity and/or high-variety information assets that demand cost-effective, innovative forms of information processing that enable enhanced insight, decision making, and process automation (https://www.gartner.com). Put simply, big data is larger, more complex datasets, especially from new data sources. These datasets are so voluminous that traditional data processing software just cannot manage them.

outdated quickly. The search results were then filtered by assessing the title, abstract, introduction, bibliography and appendix of a publication. Publications that were assessed as not relevant were not considered further and consequently not included in the corpus.

Table 1. Most important keywords of the literature review

Keywords
i.e. guidelines, handbook, recommendation, best/good practice, IT-system, technology(-ies), analysis, extraction, aggregation, data analysis, how to, tutorial, challenges, difficulties, lessons learned, social media monitoring, crowdsourcing, disaster, crisis, emergency, management, alert tools, social listening API, alternative + 'tool name', classification of IT-systems, taxonomy, inventory, knowledge base, negative impacts, positive impacts, difficulties, problems, issues, digital volunteers

Building on the literature research, a thorough business market analysis was conducted. An essential input for the business market analysis were existing market analyses that were identified within the literature research. The collection was then extended with the help of a snowball procedure and through an extensive internet search focusing on commercial providers of DCT. The results were supplemented through inputs from conference, events and exhibitions as well as continuous practitioner discussions and general domain monitoring. Those inputs are equally relevant to the business market analysis and especially the involvement of the practitioners was essential for gaining the initial requirements for the schema.

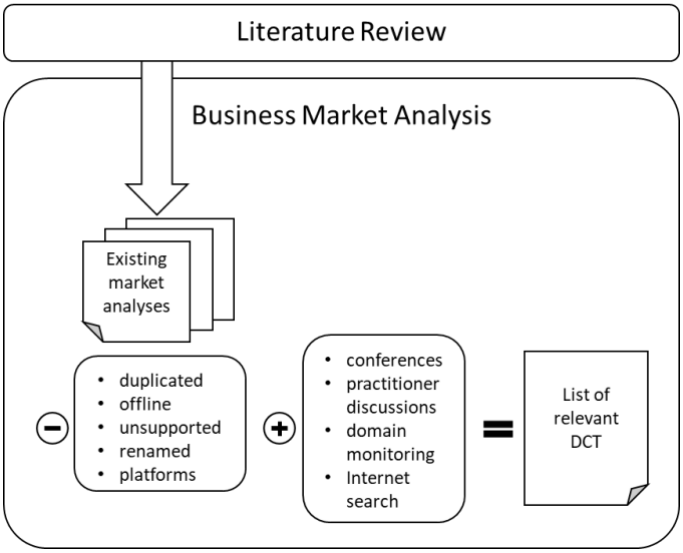

Figure 1. Procedure of the conducted business market analysis

The results of the literature review and the business market analysis led to a large list of DCT that still needed to be consolidated. This was done in a multilevel process. First, duplicates were identified and removed. Then all DCT were examined to see whether they still had active software support. This is an essential point since the function of an unsupported DCT cannot be guaranteed. Therefore, DCT that do not have active support have been removed. In addition, it often happened that a DCT could no longer be found because the website was no longer online. Those were also removed.

After this process the consolidated list contains 68 relevant DCT from 27 different countries. The USA (34) outweighs the United Kingdom (8) and Germany (6). This knowledge allows the assumption that it is worth digging deeper into e.g. the USA to evaluate their experiences with the technologies, but also to look for new(er) developments. The list of DCT can be found in Table A in the Annex. As the technology landscape is always changing, the search and selection of relevant DCT is considered an ongoing process and is therefore continuously expanded.

From the combination of the literature review and the business market analysis the categories for the DCT-schema were identified. The categories were formed from the available material via an inductive process. The consolidated categories were then translated into the DCT-schema. To identify and develop appropriate categories for a classification schema all relevant DCT were examined in depth for information on its properties. Primary sources include websites of the DCT with public available documents (e.g. whitepapers, product

manuals, or product videos). In addition, if available, free demo versions were tested. Secondary sources included information about properties extracted from product comparison sites (e.g. trusted.de or g2.com). These sites are specialized in (business) tools comparisons. We identified such sites using the keywords "<toolname> + alternative" as a keyword in a Google search. The collected information was used to iteratively identify common properties among the technologies. The extracted properties were then grouped and categorized in a property comparison table.

FINDINGS

Below we discuss the extracted categories. It is important to note that the schema - and thus the underlying categories - is not seen as a static outcome with a clearly defined end goal, but rather as a continuous, iterative process that will change the schema as needed piece by piece in an evolutionary way.

The categorization aims at describing a DCT as precisely, extensively and differentiated as possible to provide following benefits for different stakeholders:

- establishing comparability of DCT
- make all relevant information easily accessible and visible
- support different stakeholders in the selection of a suitable DCT
- unite knowledge of people

The sum of the categories results in the first version of the DCT-schema, which offers the possibility of presenting identified DCT in a structured way. The categories as well as the entire DCT-schema were conceived as a draft and is in the status of work in progress. In future, the categories will be evaluated, adapted, and revised by various stakeholders.

Categories

The draft DCT-schema is divided into categories in order to provide some basic classifications. With the help of the existing classifications of IT-systems and systems used in the field of crisis management, the draft DCT-schema starts with "first-level categories" (FLC). These FLC contain subcategories for further classification and description of DCT. The decision to classify DCT into these categories is based on the state-of-the-art as well as on empirical findings during the market analysis of existing DCT.

FLC 'History'

This category documents changes in the DCT-information entry. It covers, for example, a changelog (who changed, removed or added information) and the option of an additional comment on the respective change. The need for this became apparent during the initial work with the DCT-schema. In this way, entries can be tracked and queries can be addressed to the right persons in case of ambiguities. This category is more superordinate and therefore listed separately.

FLC 'General information'

The category is used to describe essential basic characteristics of a DCT. The stakeholder should be able to view the organizational framework conditions of the tool independently of the content or performance of the DCT through the general information. The subcategories are explained in Table 2.

FLC 'Phases of the Disaster Management Cycle'

The Disaster Management Cycle (DMC) is a well-known method in the crisis response community to describe the phases before, during and after a disaster occurs. The four phases of prevention, preparedness, response, and recovery are used to classify the actions of different stakeholders and to structure disaster management processes and are already well elaborated in several publications, e.g. (Mergel, 2014; Coetzee & van Niekerk, 2012). In the context of the use of social media, measures have already been assigned to the respective phases by (Gizikis, et al., 2017). In order to establish a comparability and relation to such processes, the applicability of the DCT in the DCT-schema is therefore included and will be assigned to the phases of the DMC wherever possible.

Table 2. Subcategories of 'General information'

subcategory	description
name	official name/title
website/URL	link to the website
contact information	mail address, phone number
source country	seat of the company/developer
description	short explanation
operator/owner	responsible operator/owner of DCT
public supporter	public institutions who are supporting the development (in case they exist)
target	main target of the DCT (in brief)
users (authorities / public instances)	list of users and costumers from public authorities and institutions, who are using the DCT
users (private corporations)	list of users and costumers, who are using the DCT (outside authorities)

FLC 'Crisis Communication Matrix'

Another concept often used in crisis management and also fundamental for the technical requirements is the classification of processes and measures based on the direction of communication between the authorities (A) and citizens (C) (Reuter et al., 2012). In the crisis communication matrix, the direction of communication is defined from a sender to a receiver and is divided in four channels of communication: authorities to citizens (A2C), authorities to authorities (A2A), citizens to citizens (C2C) and citizens to authorities (C2A). Regarding DCT C2A is the most data generating way of communication; furthermore, this can be done directly or indirectly. For direct communication social apps or direct messaging can be used. For the indirect way of C2A citizens do not address messages to concrete recipients.

In the context of the use of social media in crisis situations, Reuter & Kaufhold already describe numerous possible applications of social media in the different communication directions (Reuter & Kaufhold, 2018). Analogous to the DMC, for the purpose of comparability and integration into other processes, the classification into the described communication directions is included in the DCT- schema.

FLC 'Range of functions'

Probably is this the most interesting category for DMO. This category shows the range of functions of a DCT and is intended to provide information on what can be achieved in practice with the respective DCT.

Stavrakantonakis et al. developed a framework model for evaluating social media analysis tools. The motivation was to provide a guide for enterprises to choose the right tool out of a rapidly increasing market (Stavrakantonakis et al., 2012). Pohl was one of the first to analytically compare social media analysis tools from a crisis management perspective. The aim of his work was to create an overview for the management of crisis organizations (Pohl, 2013). A very detailed analysis and comparison of social media analysis tools from the perspective of crisis management is also provided by Kaufhold et al. The background to the study was the information overload in the analysis of user-generated content in social networks and the associated excessive demands on DMO when working with social media. As a solution approach, a framework (Emergency Service Interface) was developed to assess the quality of information. According to Kaufhold, however, none of the tools found by now offers sufficient possibilities for assessing the quality of information (Kaufhold et al., 2019).

Table 3 shows the categories of the mentioned classification systems. The focus of the studies is on the range of functions offered by the DCT. Some functions were mentioned more than once and thus certainly flow into the DCT-schema. The other functions were evaluated within the first work with the DCT-schema, partly sorted out or moved to the FLC 'general technical properties'.

Table 3. Categories of existing classification systems

Source	Stavrakantonakis et al., 2012	Pohl, 2013	Kaufhold et al., 2019
Criteria	sentiment analysis	sentiment	sentiment
		multi-platform	crossmedia
	visualization/dashboard	visual content	maps, diagrams
	engagement / workflow management	organizational management	collaboration/communication
		event/topic detection	alert/event detection
	influence/social profiles		influencer
	near-real time analysis	analysis	monitoring
		filtering	filter
			topic detection
			quality assessment
	API/export results		
	historical data		
		crowdsourcing	
		classification/clustering of data	

The subcategories of the FLC 'range of functions' with their description is shown in Table 4.

FLC 'General technical properties'

The subcategories of this FLC are a subset of elaborated data base schema from the FP7-project SecInCoRe[3] and the technology aspects from the research work from Stavrakantonakis et al. (Stavrakantonakis et al., 2012). This FLC covers all technical properties of a DCT that do not fall under the FLC *range of functions*. This category does not directly concern the stakeholder in terms of a functionality/feature but is relevant for the technical implementation when using DCT (for example in the sense of interoperability). The subcategories are explained in Table 5.

[3] http://www.secincore.eu/ The FP7-EU-project SecInCoRe pursued the overall aim to establish a pan-European inventory including a collection of datasets, processes, information systems and business models used by authorities in past crisis situations.

Table 4. Subcategories of 'Range of functions'

subcategory	description
Monitoring	Social media monitoring means the observation of relevant topics and discussions for an organization in social media. The observation takes place in (near) real time and can transmit collected information to analysis tools. Monitoring is a condition to perform real-time analytics and event detection (cf. next sub-categories).
Real-time analysis	The importance of real-time analytics is the ability to respond to data at the time you receive it from a monitoring system architecture. DCT must respond to events and data in almost real-time. The definition of real time in the use case of SMCS in disaster management has yet to be precisely defined, since the definition of real time analysis always depends on the sampling rate of a system, i.e. the time interval between two data acquisitions. In this case, it must first be evaluated which temporal definition makes sense for this specific application.
Event detection	Online new event detection: identifying events from live streaming documents in real-time. Involving continuously monitoring of social media and algorithms to find out relevant events from social media posts and their behavior.
Notification	The DCT has the ability to send automated notifications or messages to the user i.e. in case of an occurring event.
Location analysis	The DCT is using algorithms, meta data or content from a social media post to analyze to (exact) location of the creator of content.
Aggregation	The DCT collects and merges social media data from multiple platforms.
Clustering	Dealing with big amounts of data by using computer algorithms to classify content into groups ("clusters"). Thereby contents can be put into context. For example, a group of social media posts within similar signal words can be traced back to a type of event.
General citizens warning	The DCT supports functions of type A2C from the crisis communication matrix i.e. warning notifications.
Mapping	The DCT is collecting and visualizing clustered data i.e. on a geographical map.
Video and image source analysis	The DCT analyzes images and videos and uses an automatically detection to find out useful image-/video properties and their content.
Filter	The DCT has the ability to filter analyzed data by specified content or topics.
Diagrams	The DCT has a function to present the processed data in a graph, a dashboard or a visualized summary.
Visual analysis	Presents text-based data in special plots and diagrams for example a topic evolution over time to get more information than the size or importance of topics or contents. The user gets assist into analyzing complex data with visual overviews.
Sentiment	The DCT analyzes the mood (sentiment) of the citizen who are involved in an event.
Quality	The DCT uses methods to evaluate the quality of the gathered data or is in the position to considers the quality of its own result. The definition of content quality is not defined similar in actual literature, so this category puts all types of quality analyzes together. Quality is a diversified category and could be separated in some subcategories.
Boolean search query	Link search queries together with logical operators (Boolean functions "and" and "or"). For example, a search can be started with the condition that "Word A" and "Word B" must be included in the content.

Table 5. Subcategories of 'General technical properties'

subcategory	description
Language selection	The DCT has a function that changes the language.
Multilanguage data processing	The DCT is able to process multi-language content. A further consideration is to record which languages.
Collaboration	Synchronous interaction and cooperation of different organizations and their employees (or their volunteer helpers) while time and space restrictions can be disregarded.
CAP Format	CAP (Common Alerting Protocol) is an international standard developed by OASIS (Organization for the Advancement of Structured Information Standards) to exchange data in XML-format.
API	Application Programming Interface: The DCT offers an open interface at source code level for the integration of the functions in other programs.
Open source	The source code is public and can be changed and edited by third parties.
Standalone	The DCT that does not require any external programs or dependencies to work, it is able to work independently.
Authors meta data	All available relevant meta data from the author/writer/user like name, profile picture, creation date of account, number of posts, etc. can be extracted.
Location meta data	Available location data where the post was created can be extracted.

FLC 'General properties'

This FLC contains all non-technical properties, which are mainly concerned with aspects of accessibility. These subcategories were primarily created during the research for suitable DCT. Table 6 contains the subcategories together with a short description.

Table 6. Subcategories of 'General properties'

subcategory	description
Already used in disaster management	DCT already used in disaster management
Developed from research	DCT derived from academic research
Commercial	DCT developed with commercial background
Currently active	still supported by the developer and available
Demo version available	free demo version available or can be requested
Freeware	free availability
Only input information	DCT analyzes only incoming information from social media networks
Input and output information	DCT analyzes of incoming information and offer to communicate information on different channels
Release date	latest release date of the DCT

FLC 'Data sources'

This category covers the different types of sources that a DCT can access when interacting (e.g. collecting information), thereby the focus is currently not on a technical perspective (API and interoperability), more a generic overview of the different sources. In the current version, the following data sources were identified: commentary functions, microblogs, news pages/press releases, video websites, other crisis warning softwares/applications, instant messengers, chatting software, blogs, forums, and websites.

FLC 'Concrete use of social media'

This FLC includes the largest or most used social networks that the DCT can access or interact with. We have tried to be as inclusive as possible, but due to the large, ever-changing nature of the field, this category currently includes the largest or most widely used social networks. New and emerging platforms will be updated as the work progresses. New platforms appearing on the market, such as Tiktok[4], are also examined for their application in crisis situations and, if necessary, added to the data sources. WhatsApp[5] is also a current subject of investigation. Well aware that WhatsApp is used a lot in crisis situations, it offers only very limited accessibility and thus limited usability. In the future, however, it will be investigated to what extent so-called WhatsApp hotlines of corresponding organizations can become relevant as a component of DCT in crisis situations (United Nations Development Programme, 2020). Table 7 shows an exemplary overview of social media networks.

Table 7. Subcategories of 'Concrete use of social media'

subcategory	description
Twitter	On Twitter registered users can distribute telegram-like short messages. URL: https://twitter.com/
Facebook	Facebook allows the creation of private profiles to represent oneself, company pages for business presence, and groups for private discussion of common interests. URL: https://www.facebook.com/
Instagram	Instagram is a mixture of microblog and audio-visual platform and enables the distribution of photos on other social networks. URL: https://www.instagram.com/
YouTube	On YouTube users can view, rate, comment on and upload video clips on the portal free of charge. All kinds of videos are available on YouTube, including film and TV clips, music videos, trailers as well as self-made films and slideshows. URL: https://www.youtube.com
Pinterest	Pinterest is an online noticeboard for graphics and photographs with optional social network with visual search engine. URL: https://www.pinterest.com/
LinkedIn	LinkedIn is a web-based social network for maintaining existing business contacts and making new business connections. URL: https://www.linkedin.com/

Resulting DCT-Schema

All explained FLCs are brought together in one schema, which is implemented at the current working time through an Excel file. The current overview of the nine FLCs together with their subcategories thus result in the DCT-schema shown in the Figure 3.

[4] https://www.tiktok.com/
[5] https://www.whatsapp.com/

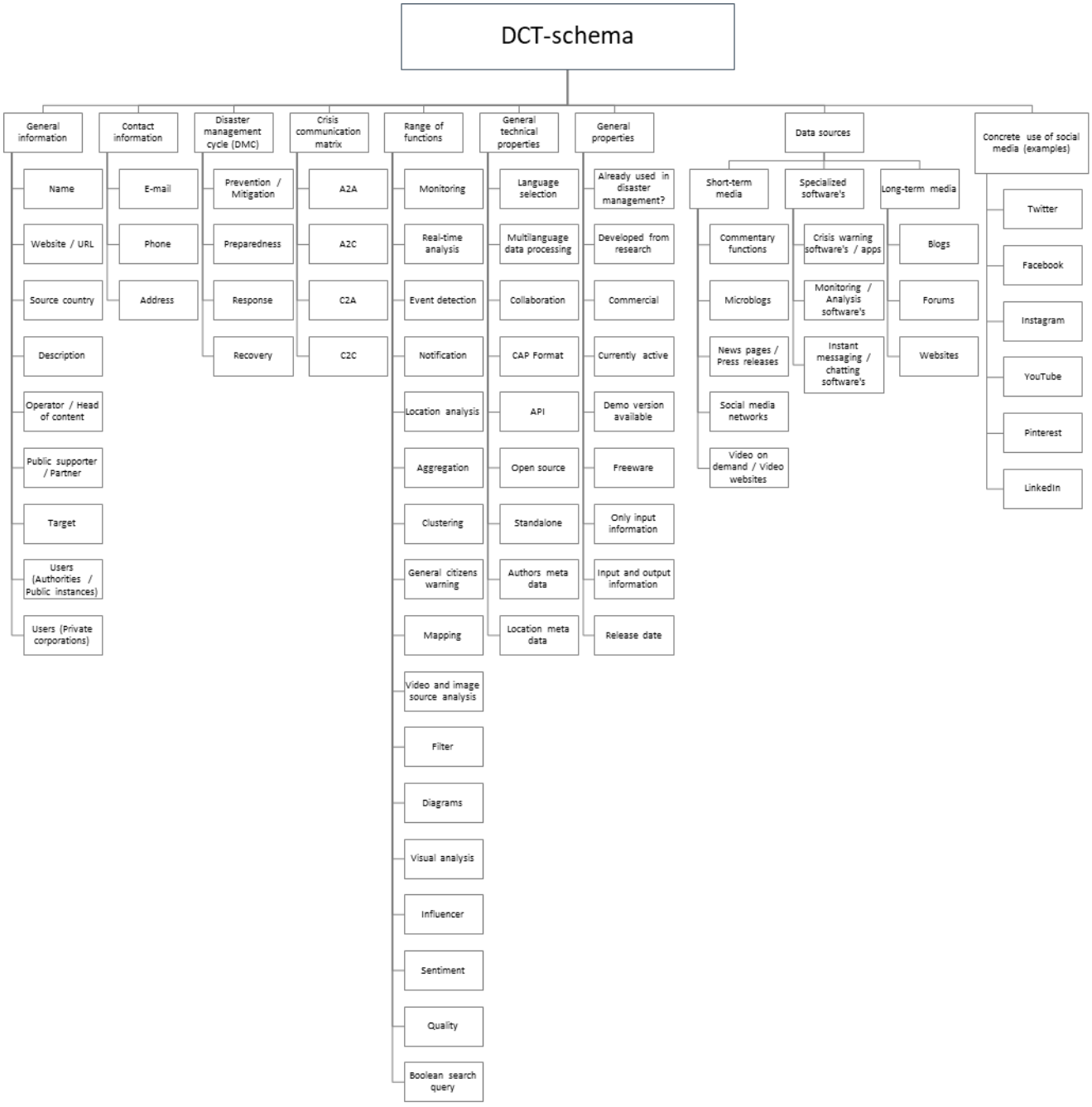

Figure 1. First draft of the DCT-schema

CONCLUSION AND FUTURE DIRECTIONS

DMO are facing major changes in the use of SMCS in disaster situations. In addition to the lack of expertise and clear guidelines for the use of SMCS, it is also the diversity of DCT offered and the fast pace of the field that poses major challenges for DMO. This paper provides a first approach to structure the diversity of technologies and applications in the field of SMCS. The aim is to go beyond a simple collection of tools and to create a database with practical information for stakeholders from different fields (e.g. for disaster risk manager as well as for researcher and also other stakeholder as the business sector). As already mentioned, this is a work in progress. The categories developed in the DCT-schema are therefore preliminary and will be iteratively revisited and refined. For example, the study developed by the Trilateral & Research Consulting includes other aspects, such as an assessment of user-friendliness or financial framework conditions (Trilateral Research & Consulting, 2015), which are not considered in the current version of the DCT-schema but are worth evaluating in future.

In addition to the research for the categorizations the DCT are elaborated and analyzed to achieve a consolidated

understanding of these technologies. This work is very extensive and time-consuming in a rapidly changing market, and plans exist to enable the filling of the DCT schema via a crowdsourcing approach.

From a content perspective the analysis and linkage of existing guidelines and recommendations for the use of SMCS in disaster situations could be helpful to DMO, as there in no standard defined. Also finished, on-going and upcoming research projects are worth more analysis and needs to be taken more into account.

From the perspective of applicability, the DCT-schema must also be discussed and evaluated with stakeholders. The aim of the DCT-schema is that it offers added value to the target group and can be seamlessly integrated into ongoing work processes. Therefore, the schema must be checked for comprehensibility. This also includes testing for the intersubjectivity of the categories presented in the schema. Guiding questions are:

- Is the schema easy to understand and comprehensible?
- Do the stakeholders interpret the categories as intended?

Interviews and surveys are currently being prepared for this purpose. In addition, the integration of further categories will be evaluated in this phase. One additional challenge is to keep the business market analyses up to date, as new DCT steadily published and old ones abandoned. The application and refinement of the DCT-schema will be future work until an appropriate level of acceptance is reached. The current list of DCT is also a glimpse of the current status quo and needs to be updated continuously.

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ANNEX

Table A. List of DCT found, February 2021

Name	Website	Name	Website
AIDR	http://aidr.qcri.org/	Mention	https://mention.com/en/crisis-management/
awario	https://awario.com/	Mitre	https://www.mitre.org/
Brandwatch Analytics	https://www.brandwatch.com/	Mozdeh	http://mozdeh.wlv.ac.uk/
Buffer	https://buffer.com/	ORA	http://www.casos.cs.cmu.edu/index.php
Cision	https://www.cision.co.uk/	Orlo (former SocialSignIn)	https://orlo.tech/
ClaraBridge	https://www.clarabridge.com/	publicSonar	https://publicsonar.com/
Coosto	https://www.coosto.com/en/	Pulsar	https://www.pulsarplatform.com/
Cogia	https://www.cogia.de/	Quintly	https://www.quintly.com/
CrowdControlHQ	https://www.crowdcontrolhq.com/sectors/emergency-services/	Radarly (Linkfluence)	https://www.linkfluence.com/de/
Crisis Tracker	https://crisistracker.org/	Sahana	https://sahanafoundation.org/
Cyfe	https://www.cyfe.com/	Salesforce	https://www.salesforce.com/
DiscoverText	https://discovertext.com/	Scatterblogs	https://www.scatterblogs.com/
Echosec	https://www.echosec.net/	Signal	http://www.getsignal.info
ESA (Emergency Situation Awareness)	https://esa.csiro.au/aus/about-public.html	Simplify360	https://simplify360.com/
Esri	https://www.esri.de/de-de/home	Social Hub	https://socialhub.io/
Evolve24	https://evolve24.com/	SocialGist	https://socialgist.com/
Facebook Business	https://www.facebook.com/business/	SocialMention	http://socialmention.com
Facelift	https://www.facelift-bbt.com/de	SocialSign.in	https://socialsignin.com/
Fanbooster	https://bytraject.com/software/social/	Sparkcentral	https://sparkcentral.com/
Followerwonk	https://followerwonk.com/	Sproutsocial	https://sproutsocial.com/
GeoFeedia	https://geofeedia.com/	swat.io	https://swat.io/de/
Gephi	https://gephi.org/	Synthesio	https://www.synthesio.com/
Google Analytics	https://marketingplatform.google.com/about/analytics/	Sysomos	https://sysomos.com/
Hashtagify	https://hashtagify.me/	Talkwalker	https://www.talkwalker.com/
Hashtracking	https://www.hashtracking.com/	Tint	https://www.tintup.com/
HootSuite	https://hootsuite.com/	TweetDeck	https://tweetdeck.twitter.com/
Hubspot	https://www.hubspot.com/	Tweetreach	https://tweetreach.com/

IBM Intelligent Operations Center for Emergency Management	https://www.ibm.com/us-en/marketplace/	TweetTracker	http://tweettracker.fulton.asu.edu/
JIXEL (Alerter and Aggregator)	https://www.jixel.eu/web/en/	Twitter	https://analytics.twitter.com/about
Keyhole	https://keyhole.co/about-us/	Ubermetrics Technologies	https://www.ubermetrics-technologies.com/de/
Khoros	https://khoros.com/	Ushaidi	https://www.ushahidi.com/
Lexalytics	https://www.lexalytics.com/	Vico	https://vico-research.com/social-data-analytics/
Leximancer	https://info.leximancer.com/	Viralwoot	https://viralwoot.com/
Statistical Cybermetrics	http://lexiurl.wlv.ac.uk/	WebLyzard	https://www.weblyzard.com/
Meltwater	https://www.meltwater.com/de		