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Better Access to Terminology for Crisis Communications

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Abstract. Crisis management depends on efficient communications with professional staff and with people who are affected by the crisis. The correct interpretation of general language and technical terms is crucial to take good actions and to save valuable time. To reduce the risk of misunderstandings we need a well-established crisis management terminology. Several collections of terms have been prepared for hazard areas such as pollution, radiation, fire safety, and dangerous goods. Today such terminologies can be provided on different websites, depending on how the national crisis management is organised. This distribution and a variation of different formats and user interfaces can make them hard to use. In this paper, we propose a novel approach to enable the term definition retrieval from a selection of terminologies directly from the text where the term is used. Initial experiments show that this approach can save time both for the retrieval and for the maintenance of terminologies. People involved in training and planning can benefit from access to definitions directly from the text of online documents. Terminology maintainers can benefit from the automated generation of internal links in the terminology so that the terms used in the definition of the other terms are automatically linked.

Keywords: Terminology, ICT - Supported Crisis Communication, Crisis Glossary.

1 Introduction

Most literature in crisis management as well as in practice among crisis management practitioners, underline the importance of crisis communications to respond to small or large-scale incidents [1-8]. Therefore, the specific terms used in crisis communication must be precise, to be understood in the same way both by professionals responsible for handling a crisis and by the general citizens who need to stay in-formed about the crisis development. Precise terminology for crisis communication will reduce the risk of misunderstandings [9] among those who are responsible for responding the crisis. Communications to general citizens may also rely on their understanding of terms to ensure that they take appropriate actions in emergency situations. Unfortunately, even

though crisis terminologies often are provided freely online, the existence of such resources remains unknown to the people in general and limitedly used among professionals for preparations or in operations. On the other hand, the use of Information Communication Technology (ICT) for preparedness, during the crisis or in the recovery period is greatly adopted, especially in developed countries. The ICTs have been the main reason for recent shifting of the nature of crisis communication [10] from a centralized command structure to multidirectional communication between a range of actors from various sectors and background (language, culture, knowledge). In such urgent and complex interaction with multiple stakeholders, the risk of communication misunderstanding may increase, and the actual (meaning) of the message may not be properly conveyed. A shared conceptual meaning and understanding are as crucial as the crisis communication model or technologies to enhance the common understanding and improve the effectiveness of disaster response.

The navigation in the jungle of terms to assure correct understanding is a pressing challenge. Taking Norway as an example, this is prevalent for most of the crucial crisis management services including police, fire service, medical service and for the media. Misunderstandings caused by misinterpreted terms are often only clarified in the evaluation phase, after the crisis response is carried out. Given the organisation of crisis management agencies into different services, the solution may not be one singular set of terms with an ambition to cover all aspects and services. However, as a preferred minimum solution the different actors should have thorough knowledge about internal terms and how others use them. For the wider audience, the media has a special responsibility to use specific terms to describe crisis events. The media al-ready has style guides and tools in place for how to spell foreign names or for words to use or avoid. But they do cannot cover crisis management in a consistent way without sources of reference. This situation underlines the need to raise the crisis management terminologies in the research agenda.

This paper argues that in current ICT-based crisis communication practices there is little attention to how crisis terminology can be maintained and used efficiently for training and operations as a part of preparedness and response in the crisis management cycle. To support the earlier claim, the authors conduct a literature survey and several documentations on practices for communicating crisis response, to explore how crisis terminologies are used and maintained. In this paper, we also provide examples and sources for crisis terminology in different fields and countries and examine the current use of these technical terms. To this end, we propose a concept and a novel solution to harmonize and to integrate crisis-related terminologies. We also outline how the approach can support a robust, accessible, and more human-centric ICT-based crisis communication. The suggested approach is based on an online service demonstrated on the website for the Norwegian Association for firefighters' terminology (http://www.kbt.no).

2 Previous Studies and Paper Scope

As indicated by Mayner and Arbon [11], the need for harmonisation of the definition

of disaster terms is evident as a solid basis for building more unitary research, policy, and practice. They provide an example of analysis of the term "disaster" in a source with 110 glossaries containing disaster terminology, but only 52 contained the definition of the disaster. They point out that, even for one word, "disaster" there is very little consensus, what the disaster actually means. Mayner and Arbon [11] found at least 128 different disaster definitions. Likewise, Hagelsteen and Becker [5] raise the concern regarding the potential discrepancies in how individuals or organisations perceive the key disaster concepts. They use the essential concepts related to the "disaster risk reduction (DRR)" and "capacity development" as a test case using groups of international experts as respondents and examining documents from nine capacity development projects for DRR. Their research finds significant differences concerning how the respondents define DRR concepts. This finding strengthens the earlier study conducted by Lipson and Warren [12] that common definition of "capacity building" is not homogeneous among their respondents that covered NGOs from 18 countries.

Hagelsteen and Becker [5] point out the tendencies of people's attitude to underestimate the importance of using terminology correctly and assume that two different parties have the same understanding as a reason for this inconsistencies. In addition, Thywissen [9] argues that the definitions of the same terms were developed simultaneously and homogeneously in multiple disciplines and results in variation of definitions for the same term, causing the so-called "Babylonian Confusion." Thywissen [9] further suggests a common vocabulary of unique, well-formulated definitions and concepts, to avoid misunderstandings in the communication between different ac-tors.

Some efforts have been initiated to harmonise the crisis management terms using various approaches such as by using taxonomies [13-17], terminologies-vocabularies [18, 19], domain ontology [20-23], semantic integration [24] or developing interoperability framework [25-27]. Despite the recognizing of some limitations in the use of crisis terminology issues, how to increase the adoption of such resources in an easy way and make them accessible, is not so much studied as the existence of such resources and how to use them in day-to-day practices are still two separate issues. Reuter et. al [18], for example, address the same concern as our research, i.e. how to deal with terminology ambiguities in collaborative systems. This study, however, is exploratory in essence, while the technical approach discussed in this work is more about the conceptual and requirement level than suggesting concrete ICT solution.

Crisis glossaries are an agreed set of terminologies formally issued by the government, public agencies or associations covering different countries, intended to use for harmonising and enhancing crisis management terms. Traditionally, the use of these terms is more scholarly-education oriented, and ensuring that professionals can find and access different disaster-related glossaries uniformly, and never fully used for the more practical-oriented purpose. As a result, this domain is often overlooked, especially, how enable people to quickly find and use them whether they are needed for training, crisis communication or in crisis management operations.

For the sake of clarity, we outline several boundaries that define the scope of this paper, i.e. which ones are not part of this paper's goals, and what is the actual contribution of this paper.

Firstly, the notion of establishing the better human-centric approach and integrated crisis glossary is to be applied in the local, general crisis management practices. The idea is neither for solving multilinguistic issues nor for proposing a method for achieving agreed terms in the context of international humanitarian missions where multi-actor, multi-national responders may be involved in the affected area within a single country. However, our proposed approach can potentially be expanded into this type of international, multi-actor humanitarian mission, if relevant glossaries exist for serving humanitarian actions.

Secondly, this paper is neither intended to make new crisis glossaries which should consider non-homogeneous vocabularies, standardisation such as NIEM (www.niem.gov), conversion or translation to semantic mapping nor to analyse different understandings that may occur between organisations.

Thirdly, this paper is neither about proposing terminologies, taxonomies, vocabularies or domain ontology, nor solving technical interoperability issues. These fields have been thoroughly scrutinized through massive efforts e.g. in European projects such as DISASTER (disaster-fp7.eu), SecInCoRe (www.secincore.eu), EPISECC (www.episecc.eu), or CRISP (www.crispproject.eu), in addition to some papers cited earlier.

This paper is about the current issues hindering efficient access to terminologies for crisis communications, and a proposed approach to resolve them.

3 Methodology and Examples of Terminologies

In this article, a qualitative method is applied, especially document collection and literature review, and a simple technical implementation of integrated glossary service as a proof of concept for our suggested solution. The verification from a practitioner adds the confidence towards the need on the proposed notion.

We surveyed documents containing to obtain a sample of official information on glossaries used for crisis management worldwide. The goal is to provide a concrete illustration on the domain discussed in this paper. The glossary document examination is not intended for an exhaustive search, but instead to point out exemplary cases of the weaknesses of current presentation of emergency management glossaries, making it hard for users to find them, as explained in Section 4.

While ICT-based support or websites inform public the best practices intended for all in responding to hazard, they rarely include the terminology. The table 1 below is to show some examples.

In this paper, we propose a novel approach to support disaster communication through an innovative glossary service, integrated into the ICT-based solution, which is more human-centric oriented and accessible. This approach could be used to provide access to relevant terminologies from the resources in Table 1. The weaknesses of the current search method of these crisis terminologies and proposed and implemented technology to support more human-centric crisis glossary services are illustrated further in Section 4 and 5 respectively.

Table 1. Examples of practices for responding/alerting disasters in different countries

Country	Practice	Glossary on site	Languages covered
Japan	Emergency Warning System	Not found	English, Japanese
Queensland Australia	Standard Emergency Warning Signal (SEWS)	Not found	20 language translation service via phone call
The Netherlands	NL-Alert	Not found	Dutch only
Norway	Kriseinfo	Not found	Norwegian and English but only Norwegian up to date.
US	Integrated Public Alert & Warning System (IPAWS)	Not found	17 languages on the site

There are several initiatives across government to collect terms related to their sector of responsibility related to crisis management. The following sections present a selection of them from Norway, Indonesia and international ones from Europe. Most of them are presented in different record formats. The modes for access also vary widely from PDF documents to access via application programming interface.

In Norway, we have located three groups of sources featuring government agencies like:

1. The Norwegian Directorate for Civil Protection (DSB) or Miljøkommune (www.miljokommune.no = environment municipality).
2. Environment Agency and clusters of organisations like the KBT (a cluster for fire safety) or AFTERM (a cluster for coastal hazard terms).
3. The law, regulations and guidance notes to the law, and standards.

All of these agencies manage their own set of terms. Some of them have an international collaboration to manage translations. The KBT has a collaboration with the Federation of the European Union Fire Officer Associations with 25 languages (FEU, see Table 2). The European Environment Agency is another relevant European source covering more than 30 languages. The coverage of terms in different languages seems to vary. Globally, the United Nations Office for the Coordination of Humanitarian Affairs (OCHA) has only one glossary with five terms related to Pauses During Conflict. Most of the disaster-related terms in UN agency are maintained in UNISDR (The United Nations Office for Disaster Risk Reduction), and available in all official United Nations languages (https://www.unisdr.org/we/inform/publications/7817).

We also examine Indonesia, one of the countries that is considered by UNISDR to be among the most disaster-prone countries in the world. Indonesia faces multiple hazards such as earthquake, tsunami, volcanic eruption, flood, landslide, drought, and forest fires, and terrorism [28]. The National Disaster Management Authority of Indonesia provides a limited collection of technical terms derived from the Act Number 24 of 2007 on Disaster Management. Apparently, the terms are limited compared to the disaster risks faced by this country in different likely disaster scenarios.

In Australia, Emergency Management Australia publishes the glossary as a pdf form, as a part of Australian Emergency Manual series. The glossary is intended for different organisations: public, private and community organisations. This is an example of a glossary document that has clear intended users.

The most comprehensive collection of glossaries is gathered by the US Department of Health and Human Services. It covers a wide range of disasters, emergency managements and humanitarian relief glossaries across agencies in the US and worldwide. The summary and links to the sources can be seen in Table 2.

Table 2. Examples of technical term collections from different countries

Country	Example	Remark/name
Norway	DSB	Norwegian Directorate for Civil Protection (DSB)
	Miljøkommune	A website with resources for municipalities
	Environment Agency	National environment directorate
	Law and regulations	Norwegian legal documents
	Standards	Standards Norway, responsible for national standards
	KBT	Federation of national agencies related to fire safety
European/ International	FEU	The Federation of the European Union Fire Officer Associations
	Prevention web	UN Office for Disaster Risk Reduction (UNISDR)
	EIONET	European Environment Information and Observation Network
Indonesia	National Disaster Management Authority	
Australia	Emergency Management Australia	
US	US Department of Health and Service	

4 Current Use of Collections of Terms

The ways to retrieve the definitions are very varied, but all of them will require the user to carry out some navigation to locate the relevant definition. We are aware of five online approaches available for users:

1. General search engine (possibly use the “define:” option);
2. Search for term in general dictionary (requires user to find e.g. dictionary.com.);
3. Search for term in a relevant term source (requires user to find e.g. KBT.no);

4. Search for term in the law/regulation (requires user to find and browse lovdata.no [access to a collection of online legal resources] in Norway e.g.).
5. The user uses a built-in functionality like “Define” on an iPad or Kindle device, or a browser extension to retrieve Wikipedia definitions.

The approaches 1 and 2 will require the user to switch context from the text where the term appeared and often return many irrelevant hits. Approaches 3 and 4 require that the user is aware of the specific sources. Approaches 1-4 all have in common that the user must change context and carry out a search on some other webpage. In some cases, user typos will be caught and corrected, and some services simply do not return any hits for mistyped terms. The 5th approach can keep the user in the context but will not give access to the specific crisis terminologies.

Fig. 1. Example retrieval of the Norwegian term "antennelse" [ignition]. The text is part of a legal regulation about fire safety in buildings, and the definition is retrieved from KBT.

5 Current Representations of Collections of Terms

We note two challenges with the current practice, namely that the definitions of terms can be scattered across many sources, and that they are only available in for-mats that do not well support re-use in terms of machine-readability, such as tables on webpages or PDF documents. Tim Berners Lee proposed a Five-star deployment scheme for open data, to indicate the level of applicability for further use of the data (http://5stardata.info/en/).

As an example, we can look at the two Norwegian data sources KBT and AFTERM dealing with fire hazards and coastal area pollution hazards respectively. The data in both sources are stored in a database and published on HTML pages. So, the format is open and non-proprietary, URIs can be used to point to specific definitions of terms in the KBT source, and some of the external sources are provided as hyperlinks. This would award 5 out of 5 stars for the KBT representation. This will allow for efficient re-use and projection of these resources on other texts as indicated in the following section.

6 A Novel Approach to Access Term Definitions

The novel approach will allow the user to stay in the context where the term occurs and retrieve term definitions in a pop-up. Figure 1 shows an example from reading a Norwegian text about fire safety in buildings. The example shows the definition of the Norwegian term antennelse (set fire to/ignition).

There are some services provided on the iPhone and Kindle that can deliver a similar output. However, these are limited to their hardware platforms and do not support users with other platforms.

Important difference compared to such solutions is the crucial narrowing of scope. The selection of terms will be limited to the disaster management area to allow the user to focus on the communication and not have to wade in long lists of irrelevant search hits. Images or video clips added to the term definitions can also help to con-vey the meaning more efficiently and overcome language barriers.

The approach can also support multiple terminologies. In this way, one click can replace the time consuming exercise to send the user off to multiple websites and to locate and query the individual terminologies for the requested definition. The proposed solution can also provide a ranking among multiple terminology sources if needed.

A similar approach can be used to support translations of a selection of relevant terms into additional languages. Please not that this will not replace a complete translation but can yet help non-native speakers to grasp the message.

The solution is designed in such a way that it is accessible for all regardless of disabilities, conforming to the Web Content Accessibility Guidelines (WCAG 2.0). This means that people using a mouse and a web browser like Firefox, Chrome or Internet Explorer, will get a similar user experience like those using a screen reader like Jaws or NVDA using the keyboard to navigate among definitions of terms. The approach is also designed to work across all common web browsers and platforms including mobile devices and tablets. These capabilities taken together forms the basis of a tool to support learning [29], for disaster preparedness.

Fig. 2. Example retrieval of term definition from KBT backdraft. The definition of "forbrenning" (combustion) refer to the definition of "gløding" (glowing).

We also expect that the simplified retrieval of definitions can support the terminology maintainers in their work, e.g. to harmonize the content among the different terminologies. A time-consuming part of the maintenance of terminologies is also the bookkeeping of internal links where one term that is defined is used in the definition of another term. Changes in the glossary can have far-reaching cascading effects that are currently manually maintained. Our approach will support the automated generation of internal links as shown in figure 2.

The definitions can be shaped with simple formatting like bullets or emphasized text and can contain images. Figure 3 shows an image to illustrate the definition of the term "oljeforurensning" (oil pollution). To support the training for oral communications, the definitions can also be read aloud with an integrated text to speech solution.

Fig. 3. Example to show definition of the term "oljeforurensing" (Oil pollution) illustrated with an image

The definitions can link in external references with additional information. This way the definition can link supporting materials or further illustrations e.g. in the form of content from Wikipedia, sound files for correct pronunciation, or video clips.

7 Conclusions and Future Works

In this paper, we have argued that in the current improvement of crisis communication technologies, the importance of shared understanding regarding the main concepts in the messages being exchanged is often overlooked. Even though terminologies are available and well-made, they are not necessarily well integrated into the communication resources or easy to use. A novel approach to unify the access to multiple terminologies and to improve the retrieval functionality has been introduced. The approach has been implemented for the terminology maintained by the Norwegian Firefighters

Association (KBT) and has already demonstrated contributions to improved usability both for the terminology users and for the maintainers.

Future steps will include to enhance the capabilities of the approach to make it more robust and to seek collaboration with forward-looking crisis response organisations to carry out further experiments both for terminology maintenance and for crisis training initiatives.

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