Exploring the Design of Technological Platforms for Virtual Communities of Practice

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ABSTRACT

Virtual Communities of Practice (VCoP) refers to groups of people who share a concern about a specific domain or topic and use a virtual environment to share and increase their knowledge and expertise about this domain. This kind of social structure has intrinsic features suitable to support emergency management communities. Nevertheless, the design of specific technological platforms that support both the activity and the practice of the community is not a trivial task, especially in critical domains such as emergency management. This paper presents the inquiry process carried out over one and a half years for the purpose of generating insights about the application of VCoPs within the emergency management context. Based on a case study, a set of findings is presented about the guidelines that should be followed in order to develop suitable technological platforms that support the labor of VCoPs in the emergency management context.

Keywords

Virtual communities of practice, design research, emergency management.

INTRODUCTION

In December 2010, because of intensive and unexpected rains, the Genil River in Spain dramatically increased its flow affecting Ecija, a 40,000 population city in Seville province. As a consequence, around 800 homes were flooded and more than 3,000 people had to be evacuated. The crisis started on December 5th when the Spanish national weather service (AEMET) gave a weather-alert for the 'Sierra Nevada' area, where the Genil River originates. At this moment, an orange-level alert was activated by the Spanish emergency management agency (DGPCE) and this agency sent warnings to the members of REMER (a group of volunteer radio amateurs) who were located close to this place. On December 6th, at 19:00h, a very heavy storm started over Ecija. This fact was communicated at an early stage to the DGPCE by REMER volunteers located around Ecija. As a result, a red-level alert was activated and the evacuation of the population was carried out. The heavy storm rain produced at 7:30 AM on December 7th, an historical depth of 7.5 meters for the Genil River in Ecija, more than four times its normal depth. Finally, the rain finished later on December 7th. During all this period, the participation of REMER members was decisive to track weather forecasts and rainfall, helping also to get a better picture of the situation and its local consequences: which areas were more affected, who needed help, which kind of damages were produced, and how the evacuation was going.

This real crisis scenario is an example of how the participation of communities of volunteers is a useful instrument in emergency management activities. Communities, like the American Red Cross, the 'Community Emergency Response Team' (CERT), the 'Australian Early Warning Network' (EWN), or the Spanish 'Red Radio de Emergencias' (REMER), have always been a common way of grouping voluntarism (Waugh and Streib, 2006). Nevertheless, many of these communities only communicate in limited, synchronous, offline ways, which negatively impacts their efficiency. For instance, the analysis of the above mentioned scenario showed us that, while radio-frequency communications among REMER members worked effectively, the lack of a persistent mechanism made it difficult to analyze the exchange of information or to identify operational patterns in order to improve their activities. An alternative to overcome these limitations could be computer-mediated support of the REMER community as a virtual community of practice.

Virtual Communities of Practice (VCoPs) are recognized as a suitable social structure for supporting participation (Wenger, 1998) as well as a useful instrument to manage knowledge (Jubert, 1999). These features have suggested the design of specific technological platforms that support VCoPs in the emergency management context as a way of enhancing the participation of volunteers. Unfortunately, designing this kind of platform is not a trivial task. First of all, since emergency management is a complex domain, a large amount of critical information must be managed (Carvey and Turoff, 2007). Secondly, VCoPs involve handling concepts - such as participation, collaboration, or knowledge management - that are difficult to formalize and manage. As a result, it is necessary to deepen knowledge of this social structure within the emergency management context in order to design suitable technological platforms. So far, several authors (Diez et al, 2010; Hung & Chen, 2001; McDermott 1999) have identified a set of design guidelines that could lead to the design of technological platforms; nevertheless, these guidelines are just based on reviewing theoretical foundations about communities of practice. As a complement, this work presents an empirical study aimed at generating findings about the activity and practice of VCoPs in the emergency management context.

With the purpose of achieving this goal, an instrumental and embedded case study was conducted. As an instrumental case study, it aims at extracting a set of findings that goes beyond the particular context of the study; in this case, they could be applied to design technological platforms oriented to whatever VCoP is involved in any phase of emergency management. An embedded case study allows exploring all the factors that have influence in the community, such as its activity, its communications, the participation mode, etc. Particularly, the case study has been focused on the REMER community that is a community composed of radio amateurs who altruistically collaborate with the official Spanish emergency agency to assist in crisis situations. In order to work as a VCoP, this community is conducting a transition from an exclusive radiofrequency environment to a context in which radiofrequency will be combined with virtual technological platforms.

The paper is organized as follows. The next section describes the literature reviewed related to our work. The third section describes the activities carried out during the case study. This case study was based on interacting with community members through a process of exploration and knowledge acquisition performed using a technique called protocol analysis (Ericsson and Simon, 1993). In order to be used as a facilitator to better explore community necessities during this process, a specific tool that supports the activity of the community was developed. The purpose of the tool was to facilitate the exploration and acquisition of knowledge from the REMER community. Based on the experiences drawn from the case study, a set of findings is presented in section four. Finally conclusions and further work are described in the last section.

RELATED WORK

A Community of Practice (CoP) is a kind of knowledge-oriented structure based on participation, collaboration and knowledge management. Specifically, a CoP is defined as "a *group of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis"* (Wenger et al, 2002).

Several works treat the design of effective CoPs, providing specific guidelines. Hung and Chen (Hung & Chen, 2001) defined principles based on a synthesis of the literature in a social constructivist theory. These principles were focused on developing VCoPs oriented to e-learning. Also based on the literature, McDermott (McDermott, 1999) provided a set of guidelines for building general structures that support CoPs. On the other hand, Wenger, McDermott, and Snyder (Wenger et al, 2002) established seven key factors for designing effective and global CoPs through consultative work, investigation, and theory development. Based on a study of best practices in CoPs, McDermott (McDermott, 2001) developed ten critical success factors for building CoPs. From a technological point of view, Wenger (2001) provided an understanding of the role of technology in CoP development. The latter work established several technological features significant for developing CoPs and analyzed how these features are implemented by different platforms.

As can be noticed, some of these works just derive from the literature related to CoPs (Hung & Chen, 2001; Wenger, 2001; McDermott, 1999). As a result, these works have not considered the context to obtain their proposed guidelines. This may entail limitations at the point of putting them into practice. On the other hand, there are works whose proposed guidelines are also based on research and inquiry processes (Wenger et al, 2002; McDermott, 2001). However, most of these works provided guidelines with a general oriented purpose. This means that the proposed guidelines are not adapted to a specific application domain, and thus do not take into account the particular needs and characteristics of a specific application domain. Particularly, there are not many works that address the issue of providing guidelines adapted to the specific and complex context of Emergency Management. In this sense, only the paper of Díez, Díaz, and Aedo (Díez et al, 2010) described a set of design guidelines aimed at supporting VCoPs specifically adapted to the emergency management domain. Nevertheless, these guidelines are also based on just reviewing literature. In sum, all reviewed works present insights that have a general oriented purpose or were extracted just from the literature.

CASE STUDY: EXPLORING THE DESIGN OF A VIRTUAL TECHNOLOGICAL PLATFORM FOR VCOPS

REMER is an institutionalized community composed of radio amateurs who altruistically collaborate with the Spanish Emergency Management agency (hereafter, DGPCE) during crisis situations. The goal of REMER is to provide a weather-monitoring network in order to track weather alerts and foresee their evolution.

Currently, this community is undergoing an environment transition from an exclusively radiofrequency environment to a context in which radiofrequency will be combined with virtual technological platforms. For that reason, this transition could be considered as a suitable case study both to empirically achieve a broader understanding about the necessities of communities of volunteers within the Emergency Management domain and to explore the design of technological platforms that support VCoPs in this domain. The following subsection describes the activities carried out during the case study, focusing on explaining their purposes and outcomes.

Designing the platform

Experience has shown that people are often unable to explain how they perform their work: they are not used to explaining their job but to just doing it. As a consequence, it seems that directly asking users to express their computer support needs is not the best way to acquire knowledge (Van Someren et al, 1994). An alternative would be the use of tools or tangible instruments as facilitators to better acquire knowledge about processes, activities, and working tasks. Following this approach, a specific platform for supporting REMER activity was developed. This platform makes it possible to learn and explore design needs of the domain to later define the hoped-for findings about requirements.

The design process has been conducted according to the information system research process described by Nunamaker (1991). This iterative process, based on elaborating and assessing successive prototypes, allows exploration of the domain in a practical and incremental manner. According to Nunamaker (Nunamaker, 1991), each iteration is divided into the following stages: (i) *construct a conceptual framework* that addresses the issues related to the research problem; (ii) *analysis, design and implementation* of a prototype, including the definition of its functionalities, the understanding of the studied domain, the modeling of the solution, and its final building; and the (iii) *evaluation* of the prototype by experiments. The design process carried out in this work includes two iterations of the methodology. The first one allowed identification of the activities and the structure of REMER. The second one had the purpose of resolving the faults identified in the first iteration by domain experts.

1st iteration: identifying the activity and structure

The first activity of the iteration was aimed at identifying and transferring the activities, and the organizational and administrative structure of REMER, to a platform that supports such a community as a VCoP. With this purpose, the review of literature about VCoPs and legislation about REMER were carried out. Afterwards, several interviews with DGPCE members (the organization that sponsors REMER) shaped the analysis phase. Based on that, it was possible to design and build a web-based high-fidelity prototype that supports the main activity and the structure of REMER. This platform was named REMERWeb.

Experts from DGPCE play an essential role in REMER activity. They are responsible for declaring warnings, tracking the information provided from volunteers, and closing the warning when the crisis situation is solved. As central actors in REMER activity and Subject Matter Experts in the domain (SMEs), two DGPCE members verified the prototype. In this verification, they executed walkthroughs of the main task of the tool in order to verify its feasibility. As a result, we could identify a set of faults or misalignments in the prototype with regard to the activity and structure of the REMER community, such as mismatches with the nomenclature of warnings, inadequate content organization, understanding problems in the representation of warnings, etc.

2nd iteration: resolving the identified faults

The second iteration was aimed at resolving the problems identified in the previous iteration. As a consequence, various changes were introduced in a new version of the prototype: refinement of nomenclature of warnings, improvement of content organization, incorporation of filtering mechanisms, use of more visualization elements to improve situation awareness, etc. In this case, it was implemented as a completely functional beta version. In order to validate previously identified faults, this second draft of the system was evaluated by the same two domain experts (SMEs) as for the previous iteration. The validation of the system relied on the review of its main tasks. Finally, obtained results confirmed that the main activity and structure of REMER had been properly transferred from the community to the tool.

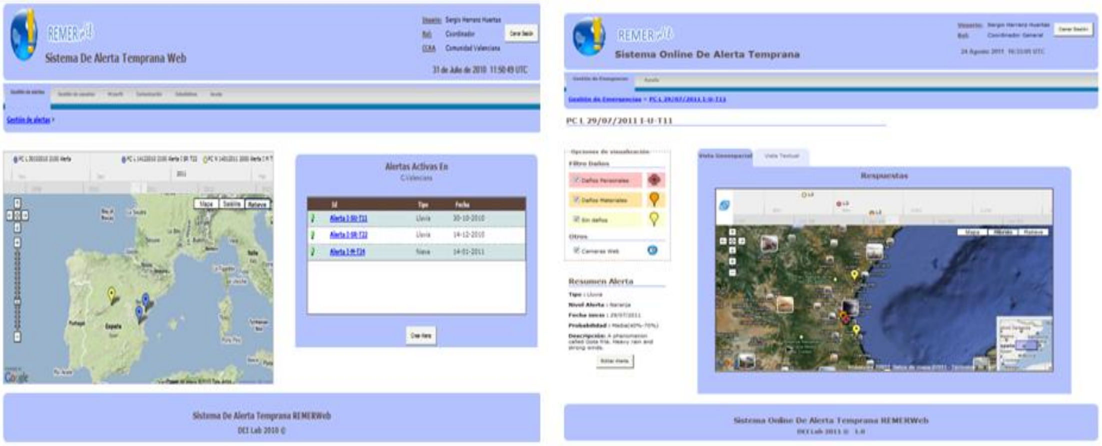

Figure 1. Front-end of REMERWeb (on the right after 1st iteration, on the left after 2nd iteration).

Validating the platform

Prior to exploring the REMER community's use of the tool, it was necessary to ensure an adequate usability level, especially for the community main tasks. An insufficient usability level could produce an early rejection of the tool by the community and even affect the inquiry process.

Methods based on expert participation (inspection methods) are especially suitable to evaluate usability (Yen and Bakken, 2009). While users can identify a symptom because the tool is not easy to use, experts will identify not just the symptoms but also their causes and they could even provide possible solutions. After an analysis of inspection methods, it was determined that the most suitable one to achieve our goal was the 'cognitive walkthrough' (Holzinger, 2005) because the priority was to ensure the usability of the tool for accomplishing the community's main tasks. In this sense, while other inspection methods aim to evaluate usability from a general point of view, the cognitive walkthrough is focused on guaranteeing that specific tasks contained in walkthroughs can be performed easily in the system.

The evaluation was carried out by six usability experts, who worked individually, and a facilitator. Walkthroughs were performed through three scenarios that cover the main tasks of the community. The results of these walkthroughs showed that it was easy and intuitive to perform the tasks in the tool. Firstly, it could be labeled as easy because all experts were able to accomplish the entire proposed task without external support. Secondly, it could be defined as intuitive because of the difference (as a percentage) between the steps followed by experts during the walkthroughs and the steps defined in advance by designers in the ideal walkthroughs was, in general, insignificant (see Table 1). For instance, the first task consisted of creating a warning in the system. The ideal walkthrough for this task was comprised of five predefined steps. In order to accomplish this task, five of the six experts performed a walkthrough with the same five steps and order of the ideal walkthrough (0% deviation). Only one expert (number 5) carried out a different walkthrough. It varied from the ideal walkthrough in just one of the five steps (20% deviation). These results reveal that the usability level of the tasks treated in the walkthroughs was appropriate.

Expert	Deviation between walkthroughs performed by experts and ideal ones (%)			
	Task 1	Task 2	Task 3	
1	0	0	0	
2	0	16,66	0	
3	0	0	0	
4	0	0	16,66	
5	20	0	0	
6	0	0	0	
Mean	3,33	2,76	2,76	Total Mean: 2,95

Table 1. Analysis of walkthroughs.

Involving REMER volunteers: protocol analysis

REMER volunteers have the widest knowledge about the community. However, eliciting this knowledge is not an easy task. A suitable technique to facilitate this knowledge acquisition is ‘protocol analysis’ (Van Someren et al, 1994). The central assumption of this technique is that it is possible to instruct subjects to verbalize their thoughts in a manner that does not alter the sequence of thoughts mediating the completion of a task, and can therefore be accepted as valid data on thinking (Ericsson and Simon, 1993). Following this hypothesis this technique was used to explore REMER volunteers’ needs while they are accomplishing their work task via the tool presented in the previous section. As aforementioned, this tool was used as an instrument to help and guide the exploration of technological necessities and the acquisition of knowledge from the community. Particularly, the process was conducted according to the following steps:

- *Formulate research questions*. The main purpose of the evaluation is to explore the needs of REMER volunteers while they are carrying out their work through the system from three perspectives: (i) activity and structure; (ii) knowledge management; and (iii) communication. More specifically, the research questions are: how should REMERWeb support the activity and structure of the community; how should the knowledge of the community be managed using the system; and what type of communications should be supported by the tool.
- *Identify sample frame.* This step includes three aspects: (i) number of participants; (ii) way to work; and (iii) source of participants. Apart from the facilitator, the evaluation was to be performed by six REMER volunteers who worked in pairs. As a requirement to guarantee some level of knowledge about the community, volunteers should have been involved in REMER for at least two years.
- *Conduct protocol analysis*. The protocol analysis was performed in a room simulating working conditions of REMER volunteers. In this environment, participants had to carry out three proposed scenarios while they were expressing aloud their thoughts, ideas, and opinions. Both verbalized thoughts and interactions with the system were recorded using a desktop screen recorder combined with an audio recorder.
- *Analyze data.* Recordings were transcribed creating what are called "protocols" (Ericsson and Simon, 1993). The protocols were studied and analyzed classifying and collecting thoughts verbalized according to the following set of pre-defined codes related to the research questions: (i) a*ctivity and structure* that refers to the sentences related to the activity and the structure of the community,*(ii) knowledge management* that concerns the ideas or suggestions about how the knowledge of the community should be managed, and (iii) *communication* that refers to the necessities about communication services in the system.
- *Report results*. Results of the protocol analysis are reported in a summary table (Table 2) that presents several findings identified by the three groups of participants and classified according to pre-defined codes.

Group of Participants	**Conclusions**
Activity and Structure	
Group 1	Community domain of knowledge should be more clear and visible to people deciding to belong to the community.
Group 2	Elements to encourage participation are necessary. Identifiers of community members are not suitable. They need a specific identity within the community.
Group 3	Name is not a good identifier for community members.
Knowledge Management	
Group 1	Lack of learning-oriented spaces to expand expert knowledge. Convenience to store and structure all the knowledge of the community in a repository to learn from past crisis situations.
Group 2	It would be useful to integrate external information interesting to the community. For instance they suggest including information in the map such as radiofrequency coverage area, Red Cross Posts situation, position and capacity of hospitals, etc. Necessity to establish best practices from the past to face new crisis situations.
Group 3	Geospatial and temporal localization in the map helps to quickly understand the activity, reducing information overload. Knowledge derived from past crisis situation is essential for the community.
Communication	
Group 1	Necessity of interaction mechanism to improve collaboration.
Group 2	Both free communication between community members and private relationships help to build collaborative relationship.
Group 3	Communication services are fundamental to encourage collaboration.

Table 2. Summary table of protocol analysis.

As shown in Table 2, the participants identified some problems or aspects for improvement, related to the activity and structure of the community. For instance, a participant from the second group described two problems:

(i) *"Participation is essential to perform our activity. REMER has more than 7000 volunteers. However the participation in the community is low. For that reason, I think the tool should provide some mechanism to encourage and judge the participation."*

(ii) *"I am checking a response. The person who sent this response is identified by the name. I cannot recognize a community member by the name. For instance, in our community we use the REMER indicative (a code) as a community identifier. This indicative would allow us knowing some characteristics of this person in the community".*

The protocol analysis was useful to collect different ideas about how the knowledge of the community should be managed and structured through the tool. In this sense, the participants in all the groups highlighted the importance of having a repository that stores and structures the community knowledge. This repository was pointed out as a useful instrument to learn from past crisis situations. An example of this idea was collected from the first group:

Person 1: *"I am going to access a warning of the last month. I can see all the replies sent to this warning. This is something very interesting but it could be improved. For our community it would be* *essential to have a repository which stores and structures all the knowledge derived from previous crisis situations."* **Person 2***: "Yes, in this way we will be able to learn from the past. For instance, it is coming to my mind the possibility of identifying risk areas based on what happened in previous years."*

Related to communication, participants mentioned the necessity to incorporate interaction mechanisms to improve collaboration in the community. A quote that illustrates this suggestion was collected from the first group:

> **Person 1**: "*I have not seen any mechanism to collaborate explicitly. The only way to collaborate using the tool seems to be to send replies to declared warnings. However, if I want to ask or discuss about something related to our activity with a specific person or group of people, I cannot. I think the tool should integrate interaction mechanisms to improve and make easier the collaboration."* **Person 2**: *"I totally agree. Mechanisms such as chats, videoconference, or instant messaging would be a great improvement to our communications."*

FINDINGS

The case study facilitated acquisition of a deepening of knowledge about the technological necessities of communities that want to work as VCoPs in the emergency management domain. As a result, it has been possible to identify a set of useful findings to be considered in the design process of technological platforms. The following presents each of them along with an explanation of how it was obtained and the technological implications of implementing such findings.

- **F1. Domain should be well-defined and public.** The domain of knowledge of a community should be clear, visible, and public. In this way, people who have passion or expertise about this domain will have enough information to decide to belong to the community.
  - *Source of evidence.* Based on REMER volunteers' opinions expressed during the protocol analysis. They considered domain of knowledge to be one of the most important reasons why people decide to belong to a community.
  - *Technological implications.* The platform has to include a public space where everybody can see the domain of knowledge of the community.
- **F2. Visualizations help to identify the evolution of the community activity**. Emergency management is a complex activity in which providing a quick response is essential. In this sense, it is necessary to incorporate visualizations to improve situation awareness (Endsley, 2000). Particularly, having a "global picture" that brings together the information about the activity in a map might be very useful.
  - *Source of evidence.* During the design process, domain experts suggested the idea of incorporating visualizations to represent the community activity as a way of reducing information overload.
  - *Technological implications.* Geographic information elements are effective for representing available information about emergency activities (Greene, 2002). These elements should be interactive to allow participation and collaboration through them. In addition, in order to avoid information overload, it must just present that information considered useful in keeping with the purpose of the community. For instance, in the case of REMER, this information must be closely related to meteorological warnings such as location, damages, evolution, etc. Additionally, this finding should be combined with finding 3 as a way of easing management of the information.
- **F3. A community needs filtering mechanisms.** Emergency management communities manage large amounts of information. For that reason, it is important to facilitate access to this information by filtering.
  - *Source of evidence.* Domain experts expressed the difficulty of accessing some community content during the design process. As a result, filtering mechanisms were introduced in the tool. Results of protocol analysis confirmed the importance of these mechanisms.
  - *Technological implications.* The information should be represented using different layers of relevant information that can be activated by filtering. These information layers are commonly integrated into visualization elements (Oppermann et al, 2006; Nóbrega et al, 2008). A

combination of these layers can produce multiple representations depending on what information is more relevant for each particular situation or user need.

- **F4. External information sources can be required to complement the community perspective.** Integration of external information related to the domain of knowledge and coming from different official channels can be required to complete and enrich the information provided by volunteers.
    - *Source of evidence.* According to domain experts' opinions, a set of external information was included during the design of the tool. Then, in the protocol analysis, community members enhanced the value of this idea and suggested including other useful external information related to the REMER domain, such as radiofrequency coverage area, Red Cross Posts about the situation, position and capacity of hospitals, etc.
    - *Technological implications.* There is a need for an interoperable mechanism with external sources of information (FEMA, 2008).
- **F5. Elements to encourage participation are necessary in a volunteer community.** Participation is a crucial element in communities of practice. In fact, it shapes the community (Wenger, 1998). However, in communities based on voluntarism, participation could be below what is desirable. As a consequence, a tool that supports this kind of community needs elements to motivate participation.
    - *Source of evidence.* REMER has a large number of volunteers who belong to the community. Nevertheless, protocol analysis showed the concern of REMER volunteers about the low participation in the community. For that reason, they proposed the idea of providing elements to encourage participation.
    - *Technological implications.* Participation can be encouraged by promoting a regular and shared rhythm for the community (Wenger et al, 2002), including elements such as a shared calendar, reminders, hot topics, synchronous events recording, etc. Others ways to encourage participation are the possibility of personalizing the platform or judging the historical participation through, for instance, an internal profile of each member of the community.
- **F6. Learning should be supported through specific spaces**. Learning is an important goal of CoPs (Wenger, 1998). In order to achieve this goal it is fundamental to have technological services that allow interaction between experts and novices. These services should be focused on expanding community knowledge in order to facilitate newcomers' learning and top-down knowledge transmission (from experts to novices).
    - *Source of evidence.* Protocol analysis noted that for REMER volunteers it was important to include services that facilitate learning from the community, especially from experts.
    - *Technological implications.* The platform should include elements such as wikis, forums or question-asking facilities.
- **F7. Interaction mechanisms are important to improve collaboration**. Integration of interaction mechanisms that allow people to directly communicate among themselves would be convenient to improve and facilitate the collaboration.
    - *Source of evidence.* Community members expressed their concern about the lack of interaction mechanisms in the tool. According to their opinion, these mechanisms are vital to promote and facilitate collaboration in a community.
    - *Technological implications.* The platform should incorporate interaction mechanisms such as chat, videoconference services, discussion boards, or instant messaging. During the evaluation, participants highlighted chats as one of the most suitable mechanisms because they are synchronized and less intrusive than others.
- **F8. Both free communication among community members and private relationships help to build collaborative relationships**. It is important to allow free communication among community members as well as private relationships to generate reliability and mutual engagement.
    - *Source of evidence.* During the protocol analysis, REMER volunteers revealed that if communications are predetermined and private conversations are not allowed it will be difficult to generate reliability among community members. In their opinion, this is the basis of collaborative relationships.

   - *Technological implications.* Interaction mechanisms should be designed without constraints and they should support multiple types of conversation such as private, public, in groups, etc.

- **F9. Repository of communal resources facilitates learning from previous crisis situations**. Online environments provide persistent communication channels. Thanks to these channels, it is possible to configure a repository that collects all the information managed by the community. This repository should facilitate learning from previous crisis situations and identify best practices.
   - *Source of evidence.* During the protocol analysis, REMER volunteers accessed past warnings and consulted all the available information. They appreciated this information as a way to learn from past crisis situations. However, most participants agreed that a bigger effort in this direction was necessary. They considered fundamental a repository that stores not just the warnings but also all the knowledge of the community. In their opinion, this repository should be oriented to learn from previous crisis situations. As an example provided by community members, risk areas could be identified based on what happened in previous years.
   - *Technological implications.* A database or file system is necessary, where knowledge can be stored, structured, and managed. Version control, indexing, summary documents previews, creation and use of meta-data, organization of objects according to content areas and search engines are characteristics and elements that can increase the performance of this repository.
- **F10. Community members need an identity that makes them recognizable by the community**. Community members have a set of personal (name, age, location), professional (skills, role, profession) and community (status, community trajectory, participation background) characteristics that shape their identity in the community. This identity is fundamental to make members recognizable within the community.
   - *Source of evidence.* Checking warnings, some REMER members expressed that they could not identify the authors of the responses just with the name. From this verbalized thought we could extract two initial ideas: the necessity of identifying community members and therefore having an identity that makes them recognizable within the community, and the idea that this identity goes beyond the name.
   - *Technological implications*. There is a need to define a profile that includes both personal and professional information by which community members are recognized within the community. In addition, this profile could include information related to involvement in the community such as community roles or participation background.

CONCLUSIONS

Virtual Communities of Practice are knowledge-oriented structures whose intrinsic features could improve the performance of emergency management communities. The application of these structures requires a specific technological platform designed according to well-known orientations. In this sense, there are several works that provide guidelines based on just reviewing theoretical foundations about communities of practice, which may limit their application in a specific domain. As an alternative, this paper presents an inquiry process derived from an embedded and instrumental study case focused on REMER, a volunteer community within the Emergency Management context.

The main contribution of the work is a set of design findings collected from participation in protocol analysis by REMER's members. Some of these findings are completely original and cannot be found in the literature about CoPs, i.e. the recommendation about integrating external information. Other findings that figure in several works related to CoPs, have been adapted to the emergency management context; an example is the finding related to the repository of communal resources of the community. Most of the works about CoPs consider a repository of communal resources an important characteristic for CoPs. Nevertheless, this work showed that, in the emergency management domain, this repository should focus on learning from previous crisis situations, and it also provides an example of how to achieve it.

In addition, a platform that supports REMER activity has been developed and evaluated, overcoming several limitations related to the performance of this community. According to evaluation results, this platform could represent a useful instrument for the community. However, based on the obtained findings, our present efforts are focused on expanding REMERWeb toward a more generic platform that can be used by other communities of practice formed by volunteers in the emergency management domain.

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