Diffusing Crisis Management Solutions through Living Labs: Opportunities and Challenges

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ABSTRACT

Despite increasing focus on user involvement among the developers of crisis management technologies, the diffusion of these solutions in target user communities is slow. This paper discusses to what extent the Living Lab approach, based on open innovation and co-creation between users and developers, could facilitate the diffusion of crisis management solutions. Our analysis shows correspondence between the core principles of the Living Labs approach and the user interaction focus in development research in ISCRAM. However, the task urgency and criticality of crisis situations limits the possibility for testing and experimenting with technology in real use situations. Instead, the main distinguishing principle of the Living Lab approach is the nature and scope of stakeholder involvement. By creating an arena where community stakeholders participate equally with developers and researchers in sharing ideas and testing new technological solutions, chances for successful diffusion of these solutions in real use practice could be strengthened.

Keywords

Living Labs, technology diffusion, crisis management, stakeholder involvement, user interaction

INTRODUCTION

Developing effective technology support for crisis management is at the core of the ISCRAM research community, and the annual conferences document a large number of development projects in various stages. While the reports from many of these projects show great promise from different pilots and field trials, they also demonstrate how the process of bringing these technologies into real use can often be challenging and slow. And even the most well-functioning technological solution cannot be considered a success unless it is adopted by practice.

We thus argue that a key challenge for the ISCRAM research community is to be able to diffuse new technological solutions among the target users. The diffusion of innovations theory defines diffusion as "the process by which an innovation is communicated through certain channels over time among the members of a social system" (Rogers, 1995, p. 5). Successful diffusion of new technological solutions then depends on a technology transfer process characterized by mutual learning and communication among the involved stakeholders (Levin, 1993; Williams and Gibson, 1990). With the recent advent of the open innovation paradigm, increasing emphasis is put on co-innovation between developers and users (Enkel, Gassman and Chesbrough, 2009). A particular form of open innovation is the Living Lab, defined as "user-centred, open

innovation ecosystems based on a systematic user co-creation approach integrating research and innovation processes in real life communities and settings" (ENoLL, 2016).

In this paper we analyze the concept of Living Labs and discuss opportunities and challenges for further application of this concept for supporting the diffusion of crisis management solutions. This analysis forms a basis for planning the further implementation of a Living Lab as part of our Centre for Integrated Emergency Management (ciem.uia.no) at University of Agder, Norway. The CIEM Lab will facilitate development and testing of new crisis tools and technologies and training in related practices, in collaboration between research communities, technology providers, local and national responders, and voluntary organizations (Radianti and Granmo, 2015).

The next section defines the Living Lab concept, and its key characteristics. Based on this, the following section discusses to what extent the core principles of Living Labs can be applied in the domain of crisis management, and what are the related opportunities and challenges. The final section presents conclusions and implications for further work.

CHARACTERISTICS OF LIVING LABS

According to Bergvall-Kåreborn, Holst and Ståhlbröst (2009), "the purpose of a Living Lab is to create a shared arena in which digital services, processes, and new ways of working can be developed and tested with user representatives and researchers" (p. 1). The focus is on establishing co-design processes where users and developers actively work together creating the new solutions (Eriksson, Niitamo and Kulkki, 2005).

Originating at MIT in Boston and based on initial ideas in the area of smart/future homes (Eriksson et al., 2005), the Living Lab concept today is applied in a range of different areas such as smart cities, energy savings, mobile research, transport, education and healthcare (ENoLL, 2016). The European Network of Living Labs (ENoLL) was founded in 2006 as an international federation of Living Labs in Europe and worldwide, and today counts over 170 active Living Labs members worldwide (ENoLL, 2016).

One of the countries where the Living Lab approach has gained ground is Sweden. In reflecting on their experiences from over 30 R&D projects in two Living Labs, Bergvall-Kåreborn, Eriksson, Ståhlbröst and Svensson (2009) present the following five core principles for the Living lab approach:

- *Openness*; facilitating collaboration between end users, researchers and other stakeholders with multiple perspectives.
- *Influence*; viewing users as active and competent partners and domain experts, emphasizing their decision-making power.
- *Realism;* carrying out innovation activities in realistic, natural, real life settings.
- *Value;* Living Labs can involve value creation from different aspects, including economic value, business value and consumer/user value.
- *Sustainability*; referring to the viability of a Living Lab and its responsibility to the target community, highlighting continuous learning and development over time.

In addition to these principles, technological availability is also emphasized as a core aspect of Living Labs, to enable experimenting with different state-of-the-art technologies together with users (Eriksson et al., 2005). This aspect could also be seen as related to the openness principle, since the Living Lab should avoid technology lock-in and offer access to alternative technological solutions.

APPLYING LIVING LABS FOR DIFFUSION OF CRISIS MANAGEMENT SOLUTIONS

In general, the research conducted in the ISCRAM community focuses on improving practice through technology, and thus involving interaction with users in the design and development of new crisis management solutions. This interaction may take various forms. For example, Hughes (2014) reports on a participatory design workshop conducted with emergency public information officers for discussing their needs for social media support and collaboratively creating new ideas and solutions. And Meum (2014) discusses how the Action Design Research approach could be applied as a basis for interaction among researchers, practitioners and end-users in co-design of emergency management solutions.

While the Living Lab approach shares similarities with other forms of user involvement such as design workshops, pilots and field trials, it is intended to go beyond these practices in the degree of involvement and

influence of the stakeholders involved and in implementing the core principles presented above.

In our literature review so far, we did not come across many experience reports yet from Living Labs in the area of crisis management. One of the few articles was from the Dutch Aristoteles project, with the main goal of "bringing together academia and practitioners in the development and evaluation of dashboards visualizing the state of crisis preparedness" in a regional multi-agency safety organization involving the police, fire and ambulance services (Bharosa, Janssen, Meijer and Brave, 2010). The methods applied in this Living Lab project included interviews with stakeholders, group brainstorming and voting sessions, prototyping of dashboards, evaluation through gaming simulation, and pilots for implementation and feedback. Further, the GeoVista Centre at Penn State University reports applying a Living Lab framework for developing geospatial information technologies supporting crisis management, combining cognitive fieldwork and simulations of realistic emergency scenarios (MacEachren, Cai, McNeese, Sharma and Fuhrmann, 2006). A more recent initiative is the Kathmandu Living Lab, focusing on "co-creation and implementation of mobile and internet-based technology solutions to enhance urban resilience and civic engagement in Nepal", involving a community of software start-ups, technology incubators, universities, and the local chapter of OpenStreetMap (kathmandulivinglabs.org).

In the following, we apply the Living Lab principles from Bergvall-Kåreborn et al. (2009) presented in the previous section, as a basis for briefly discussing the viability of the Living Lab concept for diffusing crisis management solutions.

Related to the ***Openness*** principle, the crisis management domain involves a heterogeneous community of stakeholders, including first responders, voluntary organizations, and regional and national authorities. In general, effectively bridging different disciplines and work cultures in industry-academic collaboration is proved to be challenging (Barnes, Pashby and Giddens, 2002). In crisis management, this is further challenged by the task urgency and criticality, making it difficult for first responders and operative personnel to firmly commit to preplanned Living Lab activities. Reuter, Pipek, Wiedenhoefer and Ley (2012) also discuss the challenges of terminological ambiguities in inter-organizational crisis operations. And Bharosa et al. (2010) point to that involving all stakeholders in the Living Lab might reduce the speed of this process since each stakeholder has its own goals and (technical) preferences. Yet, to enable diffusion of the new solutions in the user communities, it is vital that all stakeholders are represented for creating ownership and 'buy-in' and avoiding the 'not invented here syndrome'.

Regarding technological availability, the general focus on open source systems and crowdsourcing solutions in crisis management supports well the openness principle, and the focus on experimentation with different technological solutions.

In terms of ***Influence***, adoption of new technological solutions intended for first responders and/or government bodies is dependent on a formal 'authority innovation decision' (Rogers, 1995), i.e. a decision made by relatively few individuals in a system who possess power, status, or technical expertise. Thus, compared to innovations targeting consumers and involving optional adoption decisions by individuals, the decision-making power of the crisis management stakeholders should be emphasized strongly in evaluating ideas and alternative design solutions.

The principle of ***Realism*** is key to the Living Lab approach, with co-innovation intended to take place in realistic and real-life settings: "In Living Labs, the approach is for real-world contexts, real users, and real use situations. This means that users are involved in their own private contexts all day round. Hence, when a Living Lab approach is applied, the aim is to create as authentic use situations as possible. In traditional user involvement processes, users can be asked to use a system or device in a so-called field study. In these processes, the user is requested to use the device in a context in which the researcher, or developer, can observe users' actions and how the technology impacts them; hence, the use situation is not fully authentic." (Bergvall-Kåreborn et al., 2009).

Creating authentic use situations for testing and evaluating new solutions is a general challenge in crisis management, resulting in creative evaluation designs for emulating the real use context as close as possible. For example, Haugstveit, Rake and Eide (2015) present a plan for practitioner-centered, long-term testing of the ICT-based triage system in the BRIDGE project, which involves equipping four ambulances in two cities with eTriage devices and using these with real patients over a six week period. But the plan also includes contingencies: "Of course, should an actual and critical incident occur, exceptions can be made. The trial shall not in any way inflict delay to the handling of any situation". This again illustrates that in real crisis situations,

emergency responders are reluctant to introduce any new factors that may represent a risk for disturbing well-established practices.

Similar, Ley, Ludwig, Pipek, Randall, Reuter and Wiedenhoefer (2014) report from the development of two prototypes supporting inter-organizational information sharing and situation assessment, that was planned to be field tested under real use conditions. However, it turned out that the pilots for the most part were not used in real-work contexts as anticipated, due to problems with integration with existing infrastructures and also due to the prototypes (naturally) not including the entire amount of information already available in existing systems in use. This led the authors to conclude: "We strongly support the view, that real-time, real-world analysis and evaluation of crisis management is difficult, not to say impossible" (p. 381).

Given these challenges, we realize that the Living Lab approach in crisis management in most cases will not be able to include experimentation and field trials in real use situations, at least not when involving first responders, and need rather to be based on emergency exercises, simulations, and other non-authentic use contexts.

Regarding creating ***Value*** for the stakeholders, there seems to be a general consensus among crisis management stakeholders of the need for improved technology support. The complexity of sharing information and expertise in inter-organizational crisis management is well documented (e.g., Ley et al., 2014), and there is a general lack of standardized solutions for information sharing and coordination among different stakeholders (Meum and Munkvold, 2013). Thus, through the necessary discussions for reaching consensus on prioritization of requirements and design considerations, it should be possible to arrive at a shared set of values among the stakeholders involved. Bharosa et al. (2010) also report how the Living Lab in their experience generated better ideas and allowed the detection and elimination of the 'probably unsuccessful' ideas faster.

Finally, for a Living Lab in the crisis management domain to be able to achieve ***Sustainability*** will largely be a matter of resources available. With commercialization of the technological solutions not likely to be a goal, the Living Labs in this domain would be dependent on attracting funding from research grants and sponsorship from stakeholders. Bharosa et al. (2010) also report as a weakness of Living Labs that they require "a lot of time and budget". Yet, given the increasing attention to the need for improved technology support for emergency preparedness and management, establishing viable Living Labs in this domain would not seem insurmountable. However, in addition to the question of resources, it also requires a long-term, shared vision: "In Living Labs there is a need to combine highly self-organized and self-managed processes with multi-disciplinary R&D and innovation management processes. There must also be in place a communication culture and collaborative social and technological infrastructure for continuous shared vision and mission creation, as well as for learning from experience." (Niitamo, Kulkki, Eriksson and Hribernik, 2006).

CONCLUSION

In this brief analysis, we have discussed opportunities and challenges of applying the Living Lab concept as the basis for diffusion of technology solutions in crisis management communities. We argue that the core Living Lab principles of openness, influence, realism, value and sustainability are well in line with the user interaction focus in much of the current development research in ISCRAM. However, we have also pointed out challenges in achieving realism in the true sense of users testing and experimenting with the technology in real use situations. This again means that the Living Lab concept will not seem to differ markedly from other evaluation approaches undertaken within crisis informatics. Rather, what could be the main distinguishing characteristic is in the nature and scope of stakeholder involvement as defined by the principle of openness. By creating a permanent arena where different community stakeholders participate on equal terms with developers and researchers in sharing ideas and testing new technological solutions, the chances for successful diffusion of these solutions in real use practice could be strengthened. Further research should document experiences from Living Lab implementations in crisis management, to increase our understanding of the potential of this approach.

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