Recover Faster from Disaster: Success Factors for a Crowdsourcing Platform

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ABSTRACT

In this paper, we present a model that identifies seven success factors for the development of crowdsourcing platforms for disaster recovery. This model integrates two existing theories. The first theory focuses on success factors of crowdsourcing initiatives in general. The second theory states how disaster relief operations can improve when they take the psychological components of resilience into account. By merging the core principles of these two theories and adding additional knowledge gained from literature study, we constructed an integrated success factor model for use in the development of crowdsourcing applications for disaster recovery. An initial validation of the success factor model was conducted within a case study on a crowdsourcing platform for disaster recovery which is currently being developed. Conclusions are drawn with regards to the applicability of the model to guide development of crowdsourcing platforms for disaster recovery.

Keywords

Disaster recovery, crowdsourcing, psychological factors, social media, success factor model

INTRODUCTION

This paper aims to answer the question how a disaster crowdsourcing platform must be designed in order to achieve success: a continuing involvement and willingness of crowds to contribute to the platform. Since individuals will contribute their efforts to the platform and interact with the system, the design of the platform is crucial for success. So the question is: which factors contribute to the success of crowdsourcing platforms for disaster recovery? More in particular, this study explores how a crowdsourcing platform should be designed to avoid the challenges of crowdsourcing and to prevent the problems that are caused by the shortfalls of existing social media in supporting disaster recovery. To this end, we have developed an integrated success factor model for designing crowdsourcing platforms. This model serves as a template to support the development and evaluation of a disaster crowdsourcing platform. We derived the factors for this model from existing literature, by combining an existing success factor model for crowdsourcing in general with the psychological components of resilience, the specific motivation that the majority of people experience after disaster (Reich, 2006).

An initial validation of this model was conducted during an evaluation event of the COBACORE project, an EU-funded research project on community collaboration in disaster recovery. The COBACORE project aims to improve information sharing and close collaboration gaps between affected, responding and professional communities in disaster recovery via a crowd-sourced information platform. Analysing to what extent the COBACORE platform adheres to the success factors in our model, gave us an adequate case study to draw initial conclusions about the applicability of the model. Below, we first outline the applicability of crowdsourcing for disaster recovery. Then, we present the success factor model for the design of crowdsourcing platforms, and outline relevant literature to support the model. Next, we discuss initial findings from applying the model to the design of the COBACORE crowdsourcing platform for disaster recovery. Finally, we discuss the applicability of the model and draw conclusions on its value and further development.

CROWDSOURCING

In general, crowdsourcing can be described as the phenomenon where large groups of people ('the crowd') is used as the primary source of required services or content, typically on a voluntary basis and using internet-based channels. There are many different manifestations of crowdsourcing principles, but they boil down to the same principle of employing the collective capacities of a crown to address a challenge in a more profound of efficient manner than through traditional supply channels. For example, Kittur (2013) describes crowdsourcing in perspective of *crowd work* as the act of rapidly collecting information from a large group of people (the crowd) to accomplish tasks on a global scale. Disasters are prime examples of situations where the collective capacity of the crowd can make a difference. If properly organised, the crowd can bring direly needed extra capacities to professionals, and help accelerate the disaster recovery process. Also, crowdsourcing platform help to bridge collaboration and information gaps between the various communities that play a role in disaster management (Neef, 2013). In that perspective, it should not be surprising that crowdsourcing platforms are a major subject of research and development in the disaster response community.

During or in the wake of a disaster, a crowdsourcing platform can be used to gather information from the community, such as their needs or their capacities (Neef, van Dongen, Rijken, 2013). In this sense, a crowdsourcing platform can be viewed as a marketplace – a site where goods and services are exchanged. This can help not only the community itself, but also response organisations. For example, Gao, Barbier and Goolsby (2011) describe an interagency map: an intermediary between the public and relief organizations. Requests are collected via social media crowdsourcing and response organizations can then take actions, share information, and coordinate with each other using the information on the map (see Figure 1).

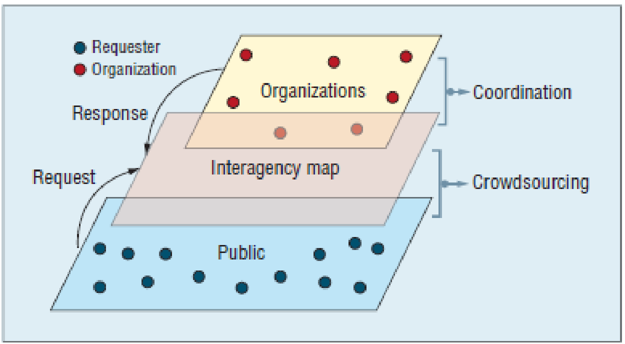

Figure 1: Interagency map. (Gao et al., 2011)

When crowdsourcing got the attention of researchers, the media, non-governmental organisations (NGO's) and formal response agencies, several disaster-specific applications emerged, such as Ushahidi, Sahana (Gunawan, 2013), OpenStreetMap, FEMA (Starbird, 2011), Haiti CrisisCamp, and GeoCommons (Zook, Graham, Shelton, & Gorman, 2010). Most applications aimed at collecting the needs and request from affected communities, where others focussed more on aggregating environmental data or the capacities of professional parties. Many of these applications have proven to be very effective during the early stages of a disaster, but generally lost their audience in later phases. So the question is: while there are several disaster crowdsourcing platforms available, which initiative will become successful and which will fail to work? The success of crowdsourcing platforms highly depends on the crowd that must provide input. The platforms are susceptible to failure if they do not attract a sufficient amount of people (Sharma, 2010). Especially after disaster, when the affected community encloses only a certain amount of people, the available pool of people that can participate – the crowd resource – is not infinite. Once that crowd is made aware of the crowdsourcing initiative it is furthermore necessary to engage and encourage people to contribute their efforts and to keep participating as long as necessary (Simula, 2013). In doing so the crowdsourcing platform is competing with several other platforms and social media tools. The crowdsourcing initiative has to attract people to use its crowdsourcing platform instead of the communication channels that the crowd is already familiar with (Simula, 2013). Moreover, the crowdsourcing initiative must also compete for these crowd resources with similar other initiatives or community engagement channels (McGonigal, 2008).

Even when sufficient people are connected to the platform, several factors can influence its further success. Here lessons can be learned from the shortfalls of social media in supporting disaster relief efforts. Firstly, social media allow the affected community to verbalise their needs, but do not coordinate the collaboration between the affected community and response organisations (Gunawan, Fitrianie, Brinkman & Neerincx, 2012). A crowdsourcing platform should furthermore try to avoid the spread of misinformation and rumours. When the credibility of shared messages is not carefully analysed, misinformation and false rumours increase chaos and interrupt disaster recovery (Abbasi, Kumar, Filho, & Liu, 2012; Gao, Wang, Barbier, & Liu, 2011). Thirdly, social media fall short in dividing and assigning responses between different relief organisations. A crowdsourcing platform should close collaboration gaps by providing an overview of the division of labour and implement a common mechanism for a more focused collaboration and cooperation between different relief organisations and other actors involved (Gao et al., 2011). Finally, finding relevant information via social media is challenging, because only a small percentage of messages contain significant information for disaster response (Meier, 2013). When at least these known shortfalls are addressed, it is possible to improve the information that relief efforts use in their decision making and response operations (Greenough, Chan, Meier, Bateman, & Dutta, 2009).

This paper explores how a crowdsourcing platform should be designed to avoid the possible complications of crowdsourcing and prevent the problems that are caused by the shortfalls of social media. In the next section we will describe this success factor model, which integrates two existing theories, to overcome these problems.

INTEGRATED SUCCES FACTOR MODEL FOR CROWDSOURCING PLATFORMS IN DISATER RECOVERY

The success of a crowdsourcing platform can be assessed on three aspects of the crowd's involvement: the platform must gather a sufficient amount of input, collect sustainable participation of its users and receive a reliable contribution (Sharma, 2010). Furthermore, since individuals will contribute their efforts to the platform and interact with the system to improve their ability to cope with the effects of a disaster (*i.e. psychological resilience*), its design is crucial and should be in line with the cognitive capabilities of its end users. More specifically, the goals, purpose and intentions of the actors involved in disaster recovery should be taken into account when developing the platform. For these reasons, our integrated success factor model for crowdsourcing platforms is based on two existing theories regarding crowdsourcing and psychological resilience: the crowdsourcing critical success factor model by Sharma (2010) and the three psychological components of resilience described by Reich (2006).

Existing models

The critical success factor model, an existing model by Sharma (2010), is focused on the motive alignment of the crowd, which determines the success of a crowdsourcing platform. Sharma (2010) describes five factors that influence this motive alignment: vision & strategy, human capital, infrastructure, linkages & trust and external environment (see Figure 41). We briefly introduce the factors in the model following Sharma's original intention.

- *Motive alignment of the crowd* - The most critical factor of the crowdsourcing critical success factor model is motive alignment of the crowd. The motivation of the people that will partake in the crowdsourcing activity should line up with the aims of the crowdsourcing initiative because this encourages their participation. Several factors further influence the motive alignment, as described below.
- *Vision & strategy* - It is central that contributors of the platform stand behind the vision of the crowdsourcing initiative. If the concept of the initiative is accurately stated and perceived as valuable and well intentioned, the crowd will support the initiative and be motivated to join. Furthermore governmental support and other valuable parties are important as well. This in turn increases trust among the crowd, which will lead to a broader participation, greater popularity and public reputation.
- *Human capital* - The crowd that offers input to the crowdsourcing platform must have the proper skills and abilities to participate and allow meaningful participation.
- *Infrastructure* - An adequate availability of technical infrastructure is needed for the realisation of a crowdsourcing platform.

- *Linkages & trust* - Linkages depend on trust and are needed for knowledge and information sharing, as the crowd devotes its free time when contributing to the crowdsourcing initiative. External support from professional responders and NGOs can add extra value for the crowd and improve the feeling of trust for the affected community.

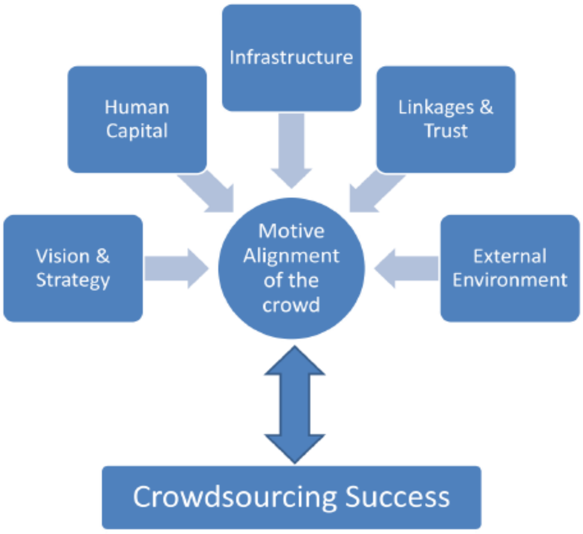

Figure 2: The critical success factor model (Sharma, 2010)

- *External environment* - The external environment influences the success of a crowdsourcing platform in different ways. The crowdsourcing initiative should be encouraged or at least not be prohibited by the government. Also, the cultural norms should be compatible with the crowdsourcing platform. Standards and values of the crowd must be related to the goal of the crowdsourcing initiative.

The crowdsourcing critical success factor model as described by Sharma (2010) misses an important element when applied to crowdsourcing initiatives that are specifically aimed at assisting disaster recovery. The intrinsic motivation of the crowd *why* they would use a crowdsourcing platform is more acute in a disaster recovery context. This intrinsic motivation is *resilience*, the behaviour to cope with the after-effects of a disastrous event. Reich (2006) describes how human resilience, the behaviour that the majority of people show after disaster, consists of three psychological components: control, coherence and connectedness. According to Reich, these three aspects of resilience should help disaster planning to increase its effectiveness. More specifically, when the design of a disaster crowdsourcing platform takes this specific intrinsic motivation into account, disaster responses can be made more comprehensive. Therefore, we need to include Reich's three psychological components of resilience into our model. We briefly introduce Reich's three components of resilience:

- *Control* - During the recovery phase of a disaster the danger of 'helping the affected community' is that it can create a state of dependency. This undermines individuals' natural sense of personal control. Studies have shown that people are enormously resilient when it is possible for them to set their own goals, make their own decisions and guide the events of their own lives.
- *Coherence* - After a disaster, the affected community is calling out for basic needs, but also for explanations for their situation. Uncertainty undermines resilience and therefore a sense of coherence is fundamental. People need to be supported in reducing this uncertainty, to provide information, knowledge and understanding about their situation.
- *Connectedness* - After experiencing a disastrous event people tend to bond together, seek out to each other and even establish bonds with strangers. For example, people who have lost relative, social bonds are crucial to recover and to find reconciliation. A supportive and strong social network will greatly enhance a person's capabilities to withstand hardship and provide the foundation for strong relationships.

A novel success factor model for disaster crowdsourcing platforms

For designing a successful disaster crowdsourcing platform we present an integrated model that combines the five success factors of crowdsourcing from Sharma's model with the three psychological components of resilience from Reich (Sharma, 2010; Reich, 2006). Our choices in constructing this model are further grounded in additional literature. In the section below we briefly introduce the seven factors of our model (see Figure 42).

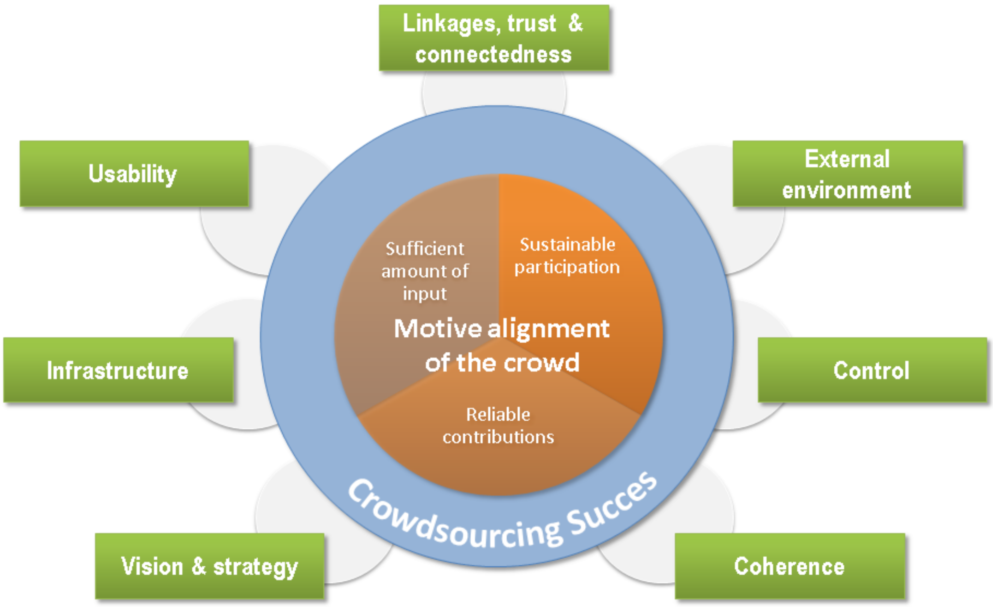

Figure 3: An integrated success factor model for disaster crowdsourcing platforms

Motive alignment of the crowd. In line with the model of Sharma (2010), the most central and critical factor of the success for a disaster crowdsourcing platform is *motive alignment*, the degree in which the intentions and facilities of the platform align with the motivations and needs of the crowd.. Alignment is based on three aspects of the crowd's involvement: the platform must gather a sufficient amount of input, collect sustainable participation of its users and receive a reliable contribution. In our model, seven factors influence this motivation:

Vision & strategy. A crowdsourcing platform supports the set of ideals, goals and objectives that is important to the crowd. If the vision and strategy is perceived as valuable and well intentioned, people will inform others about the crowdsourcing application and encourage them to use it (Venkatesh, Morris, Davis, & Davis, 2003). This will result in a larger group of people to contribute their needs and capacities. In addition to providing a vision that is supported by the crowd, it is important that the crowdsourcing concept is properly presented to the crowd. If the concept is not clear, users might no longer believe that using the platform will improve their situation or job performance (Venkatesh et al., 2003).

Usability. The crowdsourcing platform must be designed in such a way that the crowd can use the system with the cognitive and perceptual abilities it already has (Van Welie, Van der Veer, & Eliëns, 1999). We have exchanged Sharma's term of 'human capital' to *usability* to emphasise the application of the model in platform design and development. By making the system in itself easy to use, no extra education or training is needed for the crowd to be able to use the platform. Especially after a disaster, it is crucial that relief workers, survivors and decision makers are able to interact with the platform as quickly and easily as possible. Important requirements for usability are learnability, efficiency, memorability, error prevention and correction and satisfaction (Nielsen, 1993). The ease and speed at which information is retrieved and actions are performed, can be hindered by usability problems caused by a mismatch between human cognitive processes and the interaction skills that the system enforces on the user (Van Welie et al., 1999). Therefore, the platform has to be in line with the cognitive capabilities of the user. Furthermore, users' tolerance to usability problems is remarkably low, especially with infrequent use under stressful circumstances such as in the wake of a disaster.

Infrastructure. A fundamental factor that impacts the viability of a crowdsourcing platform is an adequate availability of technical infrastructure. To make sure the crowd can participate in crowdsourcing and to minimise the effort expectancy for participation, there should be an easily accessible and reliable internet connection (Sharma, 2010; Venkatesh et al., 2003). Aside from a good internet connection, the information infrastructure prior to and after the disaster is of importance. For example before the earthquake that hit Haiti in 2010, there were hardly any records of pre-disaster available resources, roadmaps, population and location. Afterwards, the available infrastructure was severely damaged. This made it more challenging for relief organisations to coordinate their efforts because there was no initial operational overview available (Zook et al., 2010). Users of the crowdsourcing platform are reinforced to use the system even more when they believe that a proper infrastructure is available that facilitates the use of the system (Venkatesh et al., 2003).

Linkages, trust & connectedness. The factors of Linkages & trust (from Sharma's model) and Connectedness (from Reich) are very similar, therefore they are combined as one factor. As described earlier, linkages largely depend on trust and are needed for knowledge and information sharing. External support can furthermore increase trust if people notice that a sufficient amount of (important) others are connected to and using the crowdsourcing platform. As a consequence, they will be encouraged to use it as well (Venkatesh et al., 2003). Further the connectedness between the affected community, responding community and responding professional organisations during disaster recovery is critical. These three groups need to share information for the assessment of damage and needs, insights on available resources and to improve collaboration (Yodmani, & Hollister, 2001). A crowdsourcing platform can support in this critical connection between communities as it allows virtual networks to emerge. In this way, people can easily connect and exchange information (Starbird, 2011).

The ties that bind people together is often referred to as social capital, which can be described as the degree of cooperation, trust, social norms and networks within a community (Putnam, 1993). Robust groups attain a key role during the recovery phase of disaster (Common stages of disaster recovery, 2008). Social capital is important for the credibility of the shared information by users of the crowdsourcing platform. Crowdsourcing platforms are typically subject to discussions on information quality and reliability. The open and often anonymous nature of these platforms facilitates the spread of rumours and misinformation. Such side-effects of crowdsourcing platforms can be mitigated by increasing social transparency and stimulating social capital, which will make people more accountable for the contributions they make. This can be achieved by encouraging users of the platform to share personal information and take away their anonymity (Huang, & Fu, 2013; Millen, & Patterson, 2003). On the other hand, a certain degree of anonymity is part of the appeal of many crowdsourcing platforms for many users. Withdrawing anonymity to limit the spread of rumours or false information might cause people to be less willing to contribute information, and thus counteract the core crowdsourcing principles of the platform

External environment. A crowdsourcing platform for disaster recovery demands a supportive external environment in which governing agencies are supportive of the platform and facilitate its efforts. Also, the cultural norms should be compatible with the crowdsourcing platform – standards and values of the crowd must be related to the goal of the crowdsourcing initiative. The social norms, in terms of the acceptance to use crowdsourcing after disaster, have an external influential component as well. If the crowd is familiar with social media, the perceived ease of use will be higher and influence people's decision to use the crowdsourcing platform (Venkatesh et al., 2003).

Control. Sense of self-control is a major factor in disaster recovery. Especially in the recovery phase of a disaster, people experience a strong urge to rebuild their homes and start their lives again. After being disillusioned by the catastrophic experience that they have witnessed (Common stages of disaster recovery, 2008), they will bounce back and reclaim personal control. In contrast, the lack of control or even the feeling of being out of control might worsen the situation and cause an increase in stress (Sapolsky, 2004). The perception of control that individuals have over their situation in general influences the way they cope with stress and engage in challenges (Lefcourt, 1982). During the recovery phase of a disaster, it is vital that individuals are supported in their efforts to regain self-control and are capable to set their own goals, and make their own decisions in rebuilding their lives. A crowdsourcing platform can provide means for the affected community to re-establish their own control, and be less dependent on the provisions of relief organisations (Reich, 2006).

Coherence. People affected by disaster want to reduce uncertainty about their situation. They will try to find explanations for what has happened to them. The need for coherence should in turn generate cognitive closure, which can be explained as an individual's motivation to get an answer to a question is part of the coping process (Kosic, 2002). By giving meaning, direction and understanding during the recovery phase of disaster, a crowdsourcing platform can generate cognitive clarity and even further enhance people's resilience (Reich, 2006). For the responders, both voluntary and professional, digital traces of team member actions provided by the crowdsourcing platform can offer observability of the work and might create a better understanding of what is going on (Landgren, 2007; De Greef, Oomes, & Neerincx, 2009). For individual responders, the crowdsourcing platform should support their decision making. Members of emergency response teams need to make crucial decisions under cognitively challenging situations. When problems with information flow and quality arise, these limit responders to gather appropriate information and consider available options, which will affect the decision quality (Cao, & Nijholt, 2008; Härtel, & Härtel, 1997). A crowdsourcing platform can be the source that provides accurate and up to date information, when presented in such a way that it reduces cognitive load and supports the work of decision makers.

INITIAL VALIDATION OF THE MODEL

The applicability of the model is that by addressing the seven success factors in the model, the relative strengths and weaknesses of disaster crowdsourcing platforms can be assessed. The factors should all contribute to some measurable aspect of these platforms. The extent to which these aspects are indicative of platform success needs to be validated, before the model can be applied. In this section we outline how we conducted an initial validation and describe our observations.

Case study COBACORE

Ideally, validation of the success factor model would include its application to multiple platforms in multiple settings and an in-depth analysis of user behaviour, user feedback and logged observations. In this 'ideal' validation setting, a profile of each platform would be created during development that shows to what extent it addresses each success factor. After giving participant a sufficient amount of time to use the platforms, adoption degree and success rates for each platform could be measured, leading to insights on the predictive strengths of each success factor. However, in reality, such a validation strategy would be hard to follow due to the amount of time this would take and the number of comparisons that would be required. Therefore, we need to look for alternative, more efficient ways to draw conclusions to the validity of the model and its factors.

As a starting point for validation, we chose the COBACORE crowdsourcing platform as our prime case study object. The COBACORE platform is the prime output of the EU-funded COBACORE project (Community-Based Comprehensive Recovery). The COBACORE project (Neef, 2014) aims to bridge collaboration-gaps between affected communities, responding volunteers and professional organisations during disaster recovery. It provides a novel way for affected communities to voice their needs and gives professionals and responding communities a means to offer capacities and build collaborations. The goal of the COBACORE platform is to make it easier to match needs with offers of help and to give professionals more insight about the state of recovery.

As a way of empirically testing the success factor model, we used a COBACORE platform evaluation event as a source of observation. This event consisted of a proof of concept evaluation of the COBACORE platform with 29 participants. These participants interacted with the platform based on their (fictional) role in a simulated disaster scenario. Their roles belonged to the affected community, responding community or responding professionals (Rijken, Pieneman, Anema, Holla, & Meesters, 2013). From the viewpoint of their role, they evaluated the added value of the platform for their disaster recovery activities. Before the scenario, they were given a thirty-minute training on how to use the platform. To give participants a baseline to compare their experiences, after the scenario with the COBACORE platform, they performed a similar scenario with existing social media tools (Twitter, Facebook, etc.). During both scenarios, observations of participant activities were conducted and each participant filled out a questionnaire on the added value of the COBACORE platform.

Observations

At the time of writing, we are still analysing the results of the case study. The initial results are in line with expectations and seem to support the validity of the model, but also emphasise the need for further substantiation. The COBACORE project case study brought us a number of observations.

The model and its factors can point designers in the right direction when designing a disaster crowdsourcing platform. It generates an overview of strong points and shortcomings as well as recommendations for further development of the platform. For example, the COBACORE platform was found to be less usable and intuitively understandable than was initially thought. On the other hand, when the usability issues would be resolved, the majority of participants indicated that they would use the platform for disaster recovery activities. Similarly, it was stated that the vision and strategy were not yet clearly communicated by the platform. Participants could indicate roughly the goal of the platform, but that was also based on the introductory training on the platform. How its goal is achieved could be made clearer by the platform. Finally, participants did have the feeling of being in control because they could input their own needs quickly. However, the lack of feedback on who was attending to their needs is still a shortcoming that needs to be addressed. These examples show that the model is a useful template by making valuable statements regarding the design and development of a disaster crowdsourcing platform.

For the evaluation, multiple evaluation methods were used (questionnaires, observations and discussion sessions). While each method had its own contribution to gaining insight into the user experience of the platform, as a whole, the various methods could be used to assess the seven success factors. For example, the questionnaires gave insight into the *extent or severity* of a specific shortcoming (i.e. the score or the number of participants that experienced a certain shortcoming). On the other hand, observations and discussion sessions provided valuable *depth and detail* into the user experiences.

As an experiment, during the evaluation event the use of the COBACORE platform was compared to using existing social media. Even though this comparison had its limitations (for instance, participants were much more experienced with existing social media than with a platform for disaster recovery), it resulted in some valuable insights. For example, even though the participants were already very active social media users, training and instruction was necessary for the COBACORE platform. Further it was striking to notice that participants felt more in control with COBACORE (because they could voice their needs effectively) but felt more connected to others using social media (because of the ‘digital proximity’ these media establish). These were valuable insights regarding the further development of the COBACORE platform.

Applicability and its current limitations

This section discusses limitations to our model and validation approach, as well as options to address these in future work. Our model is primarily intended for (re-)development of existing platforms or platforms currently under construction. Assessing the success factors of a conceptual platform that does not exist yet is hard to do beforehand. As such, there are limitations to the predictive validity of our platform, for example assessing the external environment beforehand. Furthermore, it may be hard for some cases to operationalize the qualitative concepts in the model. For example, is it possible to directly measure motive alignment of the crowd or the extent to which a platform communicates its vision and strategy? In these cases, qualitative results must suffice to assess the success factors of a given platform.

With regards to the validation approach, we could only incorporate the results of one case study. Thus, more studies are needed to establish whether the model is sufficient to help develop other platforms. So, more individual case studies or comparative analyses between multiple platforms are required to further validate the applicability of our model. Furthermore, the evaluation setting incorporated a number of simulations and fictional profiles. It is hard to say how the judgements by participants will translate to real life disaster settings: will they still be as positive regarding the use of the platform when they are confronted with real disaster recovery activities? In addition, statements as to whether the external environment (i.e. government, municipality, etc.) really supports the use of this platform could not be done in these simulated settings. This brings us to consider that the ultimate proof of the pudding is evaluating these platforms in real disaster settings; which fortunately do not happen very frequently.

Further on this success factor model should apply it on other existing disaster crowdsourcing platforms under realistic disaster settings and further validate and advance this model. For example, using the model in a robust comparative analysis between various existing similar platforms would yield relevant insights into the practical value of this model. Moreover, if proven to be valid and widely useable, this model could play an important role in the development of more crowdsourcing initiatives in the disaster management domain.

CONCLUSION

In this paper, we presented an integrated success factor model for the development of crowdsourcing platforms for disaster recovery. Based on existing theories on crowdsourcing platforms and human resilience, we constructed a seven-factor model that assesses the relative strengths and weaknesses of disaster crowdsourcing platforms. The model points designers of such platforms in the right direction for improvements and thus contributes to overall crowdsourcing platform success. We have described the results of an initial validation attempt using the COBACORE disaster recovery platform as case study. This paper has shown that the model could become an effective instrument to assessing crowdsourcing platforms on success factors, provided that the current limitations in the validation approach are addressed. Further validation with other crowdsourcing platforms is necessary to establish its value, in particular in contexts where it is possible to apply the model in incremental maturity stages of a platform under development.

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This work is based on a Master thesis report by Bonny Roos. For reasons of brevity, details on the case study work have been left out of this report. The report is available on request. Please contact the project coordinator (Martijn Neef, martijn.neef@tno.nl) in case of interest.

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