DISASTER MANAGEMENT AND INFORMATION SYSTEMS: insights to emerging challenges

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Abstract. *The information systems community continues to make significant inroad in providing theories for creating more effective systems to support Disaster Management activities. Disaster Management requires a new level of collaboration and interoperability between information systems and stakeholders within and across organisations. This broader span of collaboration and interoperability warrants new theoretical understanding and assessment methods of tailored information systems. Indeed, interoperability has been and remains a factor, but the acceptance of social media provides a new vantage point. This also requires further analysis methods of stakeholders requirements and their emerging environments. These dimensions of information systems within the context of disaster management practices are examined closely in this special issue. This editorial paper opens a gateway to these dimensions and their treatment, and provides new and innovative insights on the way forward to create more effective systems for disaster management.*

Keywords: Information Systems Theories, Disaster Management, Assessment Methods, Social Media, User Analysis

1. INTRODUCTION

Disaster Management (DM) is a complex set of interrelated activities. The activities are often knowledge intensive and time sensitive. The information systems (IS) community continues to make inroads to enhance the use of technologies to support disaster management. The community continues to identify and extend the relevant theories, and to construct new paradigms that can be brought to bear on the adoption and diffusion of information systems for disaster management. An earlier special issue of the journal of Information Systems Frontiers in 2010 made significant contributions in this space, highlighting the need for extending coordination theory (Janssen et al, 2010), exposing the limits of several organizational theories (Bharosa et al, 2010) and setting the scene to extend diffusion theories for DM inter-organizational information systems (Fedorowick et al, 2010). This special issue continues this discourse.

Challenges in inter-organizational communication remain a motivating factor in IS research and DM. However, this special issue treats the extension of some potent theories with IS readiness assessment constructs. One focus in this special issue is how do we use such theories to provide assessment methods of DM readiness. The special issue also responds to the emerging theoretical challenges associated with integration of social media in DM information systems. Since the special issue of Information Systems Frontiers appeared in 2010, semantic technologies and in particular in the context of social media applications have considerably progressed. This technical and practical angle on DM and IS receives a considerable attention in this special issue. Whilst lack of data standardization and semantics continue to hinder the interoperability, social media and improved analysis provide a new vantage point to address them. With the recent developments in semantic technologies, and further analysis of related organizational theories, interoperability and IS readiness issues in DM are tackled with new and added vigor.

In this short editorial paper, we first review the content of the issue against the recent developments outlined above. We reflect on the research paradigms on the nexus of DM and

IS and conclude with further remarks on what the next agenda for the next wave of IS efforts in this space could include.

2. Reviewing the content

This special issue of Information Systems Frontiers provides a renewed research vigor in IS and DM. On the theoretical front, it tackles the question of assessing organizational readiness in the face of an emergency. Against the backdrop of social media, it also provides both fresh theoretical and practical perspectives of suitable semantic enrichment of interactions between various stakeholders across different IS platforms. Indeed, from the number of submission received on social media, it is clear that social media platforms are providing an extremely fertile research ground to investigate those issues. Social media not only provides a very large number of data sources, but also a higher degree of heterogeneity of platforms. In what follows, the content of this issue will be reviewed and the contribution of each paper foreshadowed and framed within the identified recent IS innovation trends.

2.1.Assessment of DM readiness

Innovations in DM practices require acceptance by the stakeholders involved. Assessing user acceptance and engagement with the IT artefact is crucial before any assumptions are made about the future effectiveness of the IS innovation. Whether the innovation is technological or managerial, effectiveness requires a proper assessment of the potential impact on the organisational processes and this is clearly underpinned by an appropriate acceptance and engagement of the users. The first two papers (Wang et al, 2018; Weidinger et al, 2018) deal with this assessment issue. The first paper (Wang et al, 2018) proposes a DM capability model to assess the DM maturity of an organization. It is based on 8 criteria: leadership, resource management, communication, risk management, coordination, planning, exercise program and incident management. The maturity model mirrors CMM software development maturity model. This assessment model provides an innovative approach to assess how ready an organization is in facing emergencies. It is domain agnostic and enables assessing any organization whether it deals with floods, bushfires or any other incident type. A capability assessment model, namely, DM and control model, is proposed to provide a general guideline for different types of emergency management organization. Eight indicators are proposed for assessing the capability of the organization. The assessment process includes collecting, analysing, reporting and planning. The second paper (Weidinger et al. 2018) tackles the same important question as the first paper, but the theoretical basis is innovation diffusion theory from an IS perspective. The paper presents a qualitative study of the German fire departments to gain insights into the perceived potential of selected emerging technologies from that perspective.

2.2. Social media

Amongst a key technological innovation since the previous special issue in ISF appeared in 2010, is the emergence of Social Media platforms. Successful use of SM platforms relies on the behaviour of social media users. There is clear utility for these platforms to facilitate coordination and communication. Particularly, their utility is evident during disaster monitoring and emergency response. However, social media participants are complex social entities, contributing in different ways to their collective task and creating varying participation patterns through social media (Ogie et al, 2018). Understanding these patterns is critical to

unlock the SM potential in DM. The next three papers (Liu et al, 2018; Abedin et al, 2018; Ogie et al, 2018) in this special issue focus on SM and DM. The papers by Liu et al (2018) and by Abedin et al (2018) offer new theoretical insights and expose the limits of some existing IS theories. Whereas, the paper by Ogie et al (2018) analyses the impact of a rolled out IS application using SM in Jakarta to identify some interesting insights on various types of SM patterns that could point the way for developing new IS theories.

Paper 3 (Liu et al, 2018) provides an innovative theoretical perspective to enable effective analysis of online posts in the context of a disaster. Structuration theory is used to offer insights on reinforcing emerging and useful roles of an online community during an emergency.

Paper 4 (Abedin et al, 2018) examines the use of microblogging platforms by emergency response organisations. It highlights the potential use of Twitter. The paper highlights the need of different theories to analyse the usage of tweets from organisation users versus the usage of tweets outside the oganisational boundaries (e.g. by public or volunteers). A recent event, the bushfires in Victoria in Australia is used as a case point. While traditionally theories such as World System Theory and Institutional Theory focus on the role of powerful institutional information outlets, platforms like Twitter seem to challenge such notion by sharing the power between institutional and non-institutional players in the dissemination of disaster information.

Paper 5 (Ogie et al, 2018) also considers how to integrate the social media from outside the organizational boundaries from an emergency management organization. Indeed, their empirical evidence is consistent with the findings of Abedin et al (2018). They uncover various categories of external social media participants and identify their corresponding motivation and levels of reliability for disaster management. Their results have significant implications on developing appropriate IS theories for framing expectations and developing reliance on the use of social media for disaster management. Paper 5 (Ogie et al, 2018) analysis is rooted in empirical data analysis of flood-related information contributed by Twitter users in Jakarta during the 2014/2015 and 2015/2016 monsoonal seasons.

2.3. Stakeholder analysis

To integrate technological innovations, it is important to understand the role of human stakeholders in the process. Agent modelling is a powerful tool to enable better understanding as agents are an excellent metaphor to apply to simulate the autonomous and situated stakeholders in a dynamic environment. The last three papers focus on this.

Paper 6 (Sharma et al, 2018) uses a multi agent system simulation to predict and adjust evacuations procedures. The paper acknowledges the fuzzy and collective nature of disaster response actions. In enhancing typical agent based simulations, with fuzzy actions, the work pushes the boundaries of agent based simulations in this context. The fuzzy and uncertain features of human actions in a disaster setting is further highlighted in the work presented in Paper 7 (Kamyaniya et al, 2018). The paper focusses on the critical actions in management of medical resources (blood bank resources) in this context. Despite its clear importance in all types of emergencies, few works in the past have looked at this type of actions. Paper 8 (Inan et al, 2018) concludes the special issue with a theme that can be seen as a gateway to apply all the innovations described in this issue. It tackles the problem of how to best analyze the requirements in a way to identify system needs. It promotes the use of agent oriented analysis not only to support applications such as those presented in (Sharma et al, 2018; Kamyaniya et al, 2018), but to also manage DM knowledge sources more broadly. Such knowledge sources

often describe stakeholders, their roles and constraints in a DM. All these constructs align well with agent based concepts that underpin agent oriented analysis and modelling activities.

3. Concluding remarks

What is also clear from this special issue is that any research endeavor in DM often requires a focus on a particular disaster setting. This focus enables the validation of the conceptual efforts produced. The collection of papers are rooted in floods, bushfires and firefighting. The focus on flood and firefighting is not surprising, given that there are institutions in place to tackle these emergency types. Hence, access to case studies and data will always be easier in these two. Whilst most papers will continue to focus on firefighting and flood management, there are other types of disasters that are not covered as much and are not reflected in this special issue: e.g. earthquakes and landslides. These are also common across the whole world (unlike say volcanoes, earthquakes or landslides).

This special issue provided a forum for IS academics and DM practitioners to identify and share the challenges, opportunities, and solutions that improve disaster management systems. A particular focus is on the view point of increased use of semantics to enhance information exchange services. We seek to provide a forum to disseminate work aiming to enhance disaster management systems from the perspective of combining semantics with services and with social media, and work that enhance the theoretical understanding of such systems and their use.

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