

# A typology to facilitate multi-agency coordination

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## ABSTRACT

Multi-agency coordination in emergency management presents many challenges. Agencies that normally operate independently have to assemble into a unified supra organization to achieve a common goal. To achieve successful multi-agency coordination organizations need to span organizational boundaries and provide linkages with multiple agencies. This requires interorganizational compatibility of information and communication systems. Necessary for this success are the stakeholders responsible for facilitating these organizational boundary spanning activities. This paper proposes that the preliminary research findings can create a typology of dimensions crucial to facilitating multi-agency emergency management coordination. It is envisaged that the typology will culminate into a diagnostic tool that will enable stakeholders to examine the breakdowns and successes of multi-agency emergency management coordination.

## Keywords

Multi-agency coordination, situation awareness, emergency management, boundary spanning

## INTRODUCTION

Emergency management is faced with many challenges as society becomes increasingly vulnerable to disasters. Natural and man-made disasters impact entire communities and frequently place multiple demands on emergency management organisations. In the past 5 years natural disasters such as the 2008 Sichuan earthquake, 2010 Haiti earthquake, 2010 Pakistan floods, 2011 Japanese tsunami and Hurricane Sandy in 2012 claimed multiple lives and affected multiple communities. In the Australian context, the 2009 Black Saturday bushfires affected multiple communities across the state of Victoria. These disasters present countless challenges to emergency management agencies especially in the domain of multi-agency coordination.

Fundamental to comprehensive emergency management is the co-ordinated response of several agencies into a multi-agency response (Paton & Flin, 1999). The agencies involved have to transform from autonomous entities into interdependent decision-making teams (Janssen, Lee, Bharosa, & Cresswell, 2010). A multi-agency approach is often fraught with challenges because of competing demands and interests of organizations that need to coalesce and streamline decision making. Under these circumstances this not helped by different information systems and heterogeneous organisations.

Consequently there is a need in multi-agency incidents for stakeholders to span the boundaries between agencies and facilitate adequate linkages. However, in the emergency management context little is understood of these linkages (Schraagen & Ven, 2011). There is a requirement to understand the mechanisms that facilitate these linkages that enable stakeholders to coordinate their activities in complex emergency events. Pivotal to the success of these linkages is the requirement for stakeholders to gain an adequate situational awareness of the event. Situational awareness is fundamental to successful multi-agency emergency management coordination (Salmon, Stanton, Jenkins, & Walker, 2011). Nevertheless, information sharing and communication between agencies are challenges that have been associated with achieving an adequate situational awareness in large scale emergency events. Exploring these challenges and understanding the additional dimensions that are crucial to facilitating multi-agency coordination requires further investigation.

This paper will describe our continuing research into facilitating multi-agency coordination in emergency management. The initial research involved a comprehensive review of emergency management multi-agency coordination literature. The research has developed a preliminary typology of factors that are crucial for

facilitating multi-agency coordination in practice. The structure of this paper charts these two activities. The paper will conclude with plans for future research.

## LITERATURE REVIEW

The research analyzed literature in the domain of emergency management that investigated multi-agency coordination. Upon analysis of the emergency management literature four key areas essential in facilitating multi-agency coordination were identified. These areas were: (1) the systems that enable stakeholders to gain a situational awareness of the event, (2) the capabilities and expertise necessary for stakeholders to successfully operate in a multi-agency environment, (3) the linkages between agencies, and (4) the communication mechanisms necessary to facilitate multi-agency coordination. These four areas were chosen as they encompass the requirements necessary for stakeholders to function effectively in a multi-agency coordination environment.

### System enablers

Pertinent and timely information is essential to enable stakeholders to gain an accurate situational awareness in an emergency management event. To facilitate stakeholders gaining situational awareness, information systems were developed specifically for the emergency management domain. The aim of disaster management information systems are to emphasize the necessity of information to support successful coordination in multi-agency events (Turoff, Chumer, Van de Walle, & Yao, 2004). However, the design of disaster management information systems that support multi-agency coordination is challenging. Information system incompatibility, unfamiliarity of the system in an actual disaster and the overload of information available can compound existing difficulties in gaining a situational awareness of the event. Information technology has been identified as one of the most encouraging factors in successfully linking emergency management processes in recent times (Vogt, Hertweck, & Hales, 2011). Nevertheless, a lack of financial resources and deficiency in collaboration between agencies, particularly regarding privacy and security barriers, have been identified as obstacles to the adoption of a collaborative approach to information technology in emergency management (Reddick, 2011).

### Capabilities

Each stakeholder in a collaborative organization plays a critical role in the development of the situational awareness. The capability of stakeholders from multiple agencies to elicit appropriate information is fundamental in achieving situational awareness in collaborative organizations. Nevertheless, it is not always a requirement for every agency to have the same situational awareness, especially when different agencies may have differing objectives. To address the complexities of situational awareness in collaborative organizations it may be necessary for stakeholders to embrace situational awareness models that support collective decision making but are specific to the agencies requirements such as distributed situational awareness (Stanton et al., 2006).

### Organizational linkages

Multi-agency coordination is reliant on the linkages between agencies that allow stakeholders to collate and disseminate information to gain an adequate situational awareness of the event. Instrumental in this role is the boundary spanner who is central to the success of information exchange between agencies. Boundary spanners are an important mechanism linking an organization to the external environment and other organizations. The attributes necessary to successfully fulfill a boundary spanning role are documented in the fields of management, business, health, education, and public administration. However, the attributes described in these domains may not be suitable in the complex, dynamic and often uncertain environment of emergency management. In spite of their crucial role, little is known about how boundary spanners influence multi-agency emergency management coordination and the challenges they face (Janssen et al., 2010).

### Mechanisms of communication

The development of information technologies and in particular the internet has greatly improved communication among agencies. However, during extreme events there will be a greater density of communication to multiple agencies (Kapucu, 2006). This density of communication can prove challenging in multi-agency emergency management coordination due to communication overload. Compounding these challenges is the

incompatibility of some communication equipment between agencies and the potential failure of communications as a result of critical infrastructure breakdowns. An important consideration in communication exchange is to ensure that information is received. This need for the receipt of the information is an important aspect of communication in crisis events regardless of the communication channel used (Schraagen & Ven, 2011). When communicating with multiple agencies the receipt of information can address challenges associated with the communication of inaccurate or incomplete information (Salmon et al., 2011).

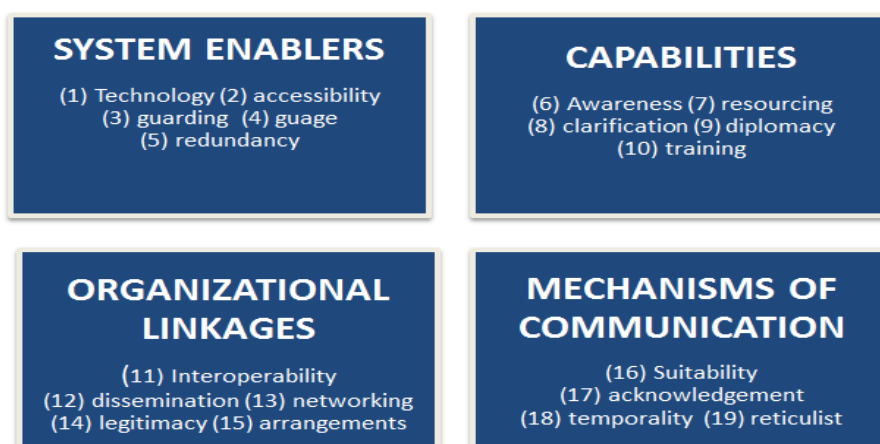
## METHODS

This study predominantly uses data from the literature review to develop the preliminary typology of factors that are crucial for facilitating multi-agency coordination in practice. The principal research project is exploring human factors in multi-agency coordination. Therefore only the features that influence the stakeholder's ability to operate in a multi-agency environment were identified in the literature. The typology is also consolidated by the preliminary findings from empirical research conducted by the research team. The broader study used a qualitative approach based on a series of interviews and observational studies. The majority of this empirical research was conducted in south east Australia using emergency management personnel from the states of Victoria and Tasmania. The participants involved with the study would all be expected to operate in state level emergency operations centers during a large scale emergency event. The participants were grouped into three areas: (1) emergency services, (2) critical infrastructure, and (3) other organizations, these included but were not limited to the military and land management agencies. The first component of the empirical research consisted of 39 in depth interviews with senior emergency management leaders instrumental in multi-agency coordination. The second component was an observational study that involved observing multi-agency coordination during state level bushfire exercises. The participatory observations involved taking field notes while following a small and selected number of participants throughout the exercise. In order to gain a greater insight into mechanisms that facilitate multi-agency coordination, periods of up to 4 hours were spent observing each participant. However, it is important to note that the empirical data is in the preliminary stages of analysis and was only used to provide confirmation to the themes identified in the literature.

## PRELIMINARY FINDINGS

The four dimensions emerge from the analysis of the data, having first been informed by the conceptualisation based on the literature review. They are presented here as a preliminary view on a complex problem and are offered for further discussion. The four dimensions highlight the fundamental requirements necessary to facilitate successful multi-agency coordination. Each of the dimensions is reliant on the collaboration of information technologies and human factors. Further analysis of the data revealed a total of nineteen indicators that construct the four dimensions. Following the 2009 Black Saturday bushfires in Victoria a Royal Commission made numerous recommendations. This research is part of the broader program conducted by the Australian Bushfire Cooperative Research Centre. Figure 1 highlights the four indicators and nineteen dimensions within each relevant indicator.

Figure 1. Preliminary typology



### System enablers

The first dimension designated system enablers refer to systems that are used to enable the successful exchange of information. To achieve this, the system needs to have the (1) *technology* requirements to facilitate the stakeholder's ability to gain timely and appropriate situational awareness. Imperative to the technological requirements is the necessity that stakeholders have (2) *accessibility* to the systems and are not hindered by (3) *guarding* of the information by security barriers. The systems needs to have the facility to (4) *gauge* the event by providing feed forward and feedback modeling of the event. This allows stakeholders to review a log of the events and have a predictive outlook of the situation. In the event of critical infrastructure failures and potential disruption of systems alternative (5) *redundancy* systems need to be established.

### Capabilities

The second dimension refers to the capabilities of the stakeholders representing the multiple agencies. These stakeholders need to encompass the ability to form a rapid situational (6) *awareness* that can aid with collective decision making. An important outcome of gaining situational awareness is the ability to determine the (7) *resourcing* requirements of the event. During an emergency event resources can be stretched and the stakeholders need the ability to access suitable and sufficient resources. This requires the stakeholder to appropriately monitor resource tracking and perform timely resource reallocation as required. Stakeholders need to have (8) *clarification* of their own agencies and the supra organizations requirements and objectives. This requires the ability to engage in (9) *diplomacy* skills to effectively mediate and negotiate with internal and external stakeholders. Effectively achieving this requires ensuring familiarity with other agencies roles and responsibilities; this is a major (but not the only) benefit of multi-agency exercises and (10) *training* prior to any disaster event.

### Organizational linkages

The third dimension is described as organizational linkages and refers to the ability of individual organizations to provide links between other organizations. From an information technology perspective this requires the (11) *interoperability* of information systems amongst organizations. This is necessary to ensure the relevant (12) *dissemination* of information to the appropriate agencies in a valid format in a timely manner. A person from an organization that is located in a different organizational system is said to be performing a boundary spanning role (Khan, Wolfe, Quinn, & Snoek, 1964). These boundary spanners use information systems to facilitate the transfer of information between agencies. Boundary spanners need to be efficient in (13) *networking* to ensure the interoperability of multiple agencies. Crucial to the stakeholder forging a successful boundary spanning role is the necessity that they and their agency have (14) *legitimacy* within the supra organization. (15) *Arrangements* with other agencies, such as memorandums of understandings, also need to be well established. All of these indicators are necessary in the response phase. However, it is necessary to ensure all these factors are also incorporated in the pre-event stage to avoid any unnecessary coordination hurdles in the actual event.

### Mechanisms of communication

The fourth dimension, mechanisms of communication, is reliant on the (16) *suitability* of the communications to cope with an increased density of traffic and must have the capability to ensure (17) *acknowledgement* of receipt of the information using closed loop communication practices. Due to the (18) *temporality* of disasters adequate timeline structures must be incorporated into any communication and information systems. Ultimately it is the responsibility of the boundary spanner to perform a (19) *reticulist* role as an information intermediary and bridge any information or communication asymmetries to achieve the common objective (Ebers, 1997).

## CONCLUSIONS AND ONGOING RESEARCH

Due to the often dynamic and complex work environment in emergency management, information systems that are often reliant on information technology need to be sufficiently flexible and able to ensure that relevant information reaches the appropriate agencies in a valid format and in a timely manner that facilitates effective action (Comfort, Dunn, Skertich, & Zagorecki, 2004). Nevertheless, the challenges of multi-agency emergency management coordination are not only confined to the domain of information technology. Stakeholders from agencies that do not have a history of working together may not understand what the other agencies requirements or what they can contribute to the situation. This unfamiliarity of other agencies roles could lead to

longer search times for finding relevant information (Schraagen & Ven, 2011). Understanding the mechanisms that facilitate multi-agency emergency management coordination is an important topic that requires further investigation.

Future research will involve the development of the typology so that it can be applied in practical situations. Following further review and validation by leaders in the Australian emergency management industry, the typology may be used as an assessment tool to evaluate multi-agency emergency management coordination in exercises or real time events. It is envisaged that the development of the typology in combination with an appropriate rating scale will provide insight into what enables or constrains effective multi-agency emergency management coordination. In this respect it will highlight areas of potential failure as well as areas that may be working well. As the overarching research project is investigating human factors in multi-agency coordination it is anticipated that the typology will contribute to crisis information systems in two ways. Firstly, understanding the capabilities of the stakeholders involved in multi-agency coordination may reveal facets of this role that need improving. Secondly, exploring the systems that enables stakeholders to fulfill their role may identify insufficiencies in emergency operations centers IT systems that can be addressed.

## REFERENCES

1. Comfort, L., Dunn, M., Skertich, R., & Zagorecki, A. (2004). Coordination in complex systems : increasing efficiency in disaster mitigation and response. *International Journal of Emergency Management*, 2(1-2), 62–80.
2. Ebers, M. (1997). “Explaining inter-organizational network formation”. In M. Ebers (Ed.), *The formation of inter-organizational networks* (pp. 3–40). Oxford: Oxford University Press.
3. Janssen, M., Lee, J., Bharosa, N., & Cresswell, A. (2010). Advances in multi-agency disaster management: Key elements in disaster research. *Information Systems Frontiers*, 12(1), 1–7.
4. Kapucu, N. (2006). Interagency Communication Networks During Emergencies: Boundary Spanners in Multiagency Coordination. *The American Review of Public Administration*, 36(2), 207–225.
5. Khan, R. L., Wolfe, D. M., Quinn, R. P., & Snoek, J. D. (1964). *Organizational Stress: Studies in Role Conflict and Ambiguity*. New York: Wiley & Sons, Inc.
6. Paton, D., & Flin, R. (1999). Disaster Stress: an emergency management perspective. *Disaster Prevention and Management*, 8(4), 261–267.
7. Reddick, C. (2011). Information technology and emergency management : preparedness and planning in US states. *Disasters*, 35(1), 45–61.
8. Salmon, P., Stanton, N., Jenkins, D., & Walker, G. (2011). Coordination during multi-agency emergency response: issues and solutions. *Disaster Prevention and Management*, 20(2), 140–158.
9. Schraagen, J. M., & Ven, J. (2011). Human factors aspects of ICT for crisis management. *Cognition, Technology & Work*, 13(3), 175–187.
10. Stanton, N., Stewart, R., Harris, D., Houghton, R., Baber, C., McMaster, R., Salmon, P., et al. (2006). Distributed situation awareness in dynamic systems: theoretical development and application of an ergonomics methodology. *Ergonomics*, 49(12-13), 1288–311.
11. Turoff, M., Chumer, M., Van de Walle, B., & Yao, X. (2004). The design of a dynamic emergency response management information system. *Journal of Information Technology Theory and Application*, 5(4), 1–36.
12. Vogt, M., Hertweck, D., & Hales, K. (2011). Optimizing ICT Portfolios in Emergency Management : A Modular Alignment Approach. *Proceedings of the 8th International ISCRAM Conference* (pp. 1–11).