Enhancing Emergency Preparedness through Effective Resource Management

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Prepared for: D4H Technologies

February 2016

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Abstract:

This research identifies the resource management systems currently deployed during emergencies, the level of satisfaction with these systems and what constitutes an effective Resource Management System (RMS) in an emergency context.

The data for this study was gathered data using an online questionnaire. The questionnaire was based on a theoretical framework developed following an extensive literature review. The results and recommendations are based on data from 352 respondents.

The results of this study revealed that 66.19% of respondents used a mix of both paper and computer based systems to manage their resources. With a system designed in house and a generic "off the shelf" resource management system being the most popular at 41.43% and 30.95% respectively.

With regard to resource management systems, the top six characteristics valued by respondents were: reliability; ease of use; ease of access - on site; accuracy; ease of access - off site; and flexibility.

Respondents who used a generic or bespoke resource management system were more than three times more satisfied with their system than respondents using a paper based approach and just under twice as satisfied as those using a system designed in house.

Keywords

Emergency Management;

Resource Management System;

Disaster Management;

Incident Management System;

Effective Resource Management.

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Funding

This research has been partially funded by Enterprise Ireland**,** and sponsored by D4H Technologies

To Cite This Document

McMullan, C. and Brown, G.D. 2016. *Enhancing Emergency Preparedness through Effective Resource Management.* DCU Business School, Dublin.

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Introduction

Modern emergency management is an interdisciplinary field based on the commonly accepted four phased approach: mitigation; preparedness; response; and recovery - though this approach has seen some minor adaptation.

> Emergency management refers to the implementation of plans, and the use of personnel and equipment to achieve the tactical and task requirements of response to address a given threat. IMS (of all types) are used to ensure that implementation takes place smoothly and effectively and designed to afford the response flexibility needed to address potential changes in the immediate threat environment (Perry 2003, p.406)

Although Perry's definition focuses on the response phase, it serves well in framing the importance of managing resources within all phases of emergency management. One vital component of Incident Management Systems (IMS) which is sometimes overlooked is that relating to the management of resources. Whether responding to a national emergency or a business crisis, resource management is essential if the correct resources are to be delivered to the correct place at the correct time. Information management, including information relating to resources, commonly looks at the collecting of relevant details and the sorting and managing of this information with a view to supporting efficient decision making. Miao, Banister and Tang (2013) suggest that "there is a gap between emergency management research and resource management study" (p.1391) hence, this research sets out to explore:

- What should an effective Resource Management System (RMS) include in order to enhance emergency preparedness and response?
- What types of RMS are currently used by emergency management professionals?

To achieve this, an extensive literature review was conducted, which served as the theoretical foundation on which the study, including the questionnaire, was built. A questionnaire was developed and distributed to over 500 emergency management professionals with 352 responses received.

Definitions

Resources and their management represent a crucial element within the

field of emergency management. Wang, Tepfenhart and Rosca (2009, p.271) highlight that a "lack of resources can cause contention, the need for some tasks to wait for others to complete, and the slowing down of the accomplishment of larger goals". Whether an organisation is private, public, or voluntary, it will most certainly require the management of resources (and information relating to these resources) during an emergency.

Ultimately, the ability and capacity to prepare, respond and recover from an emergency hinges on an organisation's human, physical (equipment & supplies), and financial resources, along with its policies and leadership. However, it is difficult to present a definition of resources which suits every organisation. With such a diversity of organisations and groups operating within emergency management, there are multiple opinions as to what constitutes a resource. While there are a number of definitions in existence, common elements such as physical, human/individual, financial and organisational capital are embedded in most (Hitt, Ireland and Hoskisson 1997; Barney and Clark 2007; Huang, Wang and Lin 2011). Key stakeholders in the resource sector includes those providing equipment, communication capability, and the resupply and maintenance of all assets (Perry 2003). Other definitions are extended to include the human element. Homeland Security (2008 p.146) defines resources as "personnel and major items of equipment, supplies, and facilities available or potentially available for assignment to incident operations and for which status is maintained". Competencies can also be classified as resources – with skills being one of the key elements (Grant 1991). Lindell, Perry and Prater (2005) note that a principle of incident control is comprehensive resource management for all assets - personnel, transport, equipment and services. With such an array of resource types, effective emergency management must include the capability to maintain continued awareness of these resources through a RMS, whether this system is paper or technology based.

Resource Management Systems: Scope and Characteristics

RMS should include "processes for categorizing, ordering, dispatching, tracking, and recovering resources. It also includes processes for reimbursement for resources, as appropriate" (Anderson, Compton, Mason, 2004, p.6).

According to McEntire (2014) and Perry (2003), resource management can be viewed as having four key tasks:

1. Describing, preparing, inventorying and tracking of resources;
2. Activating and dispatching resources;
3. Deactivating and recalling resources;
4. Providing overall accountability for resources.

The time sensitive nature of emergency response and the importance of getting the correct quantity and quality of resources to the scene makes resource management particularly challenging in an emergency context (Fiedrich, Gehbauer and Rickers 2000). Having a support system for assigning resources can enhance the efficiency and effectiveness of the emergency management operation (ibid).

McEntire (2014, p.376) suggests that resource management operates under five key principles: advance planning among agencies; resource identification and the use of standardised processes and methods for ordering; categorisation based on size, capacity, capability etc.; advance agreement regarding how resources will be used during an incident; and effective management which relies on validated practices such as credentialing and other forms of standardisation.

Governments, their agencies, NGOs and the private sector have developed frameworks and structures to improve the coordination of operations before, during and after an emergency. While there are many approaches, coordination is the central objective of all. In Ireland, 'A Framework for Major Emergency Management' (2006) sets out coordination arrangements for the principle response agencies which aids in (but is not limited to) the mobilising, controlling and making use of available resources during an emergency. "It is important, however, to recognise that it is a policy document rather than a legally binding framework" (McMullan and Brown 2015, p.46). Similarly, in the USA, the National Incident Management System (NIMS) has been established to complement other US frameworks and provide a systemic approach to incident management through mitigation, preparedness, response and recovery activities (Homeland Security 2008). Anderson, Compton and Mason (2004, p.4), drawing on NIMS, suggest incident

management systems include six key components:

1. Command and Management;
2. Preparedness;
3. Resource Management;
4. Communications and Information Management;
5. Supporting Technologies;
6. Ongoing Management and Maintenance.

The resource management component of NIMS sets out mechanisms to "identify requirements, order and acquire, mobilize, track and report, recover and demobilize, reimburse, and inventory resources" (Homeland Security 2008 p.8). As part of NIMS, Homeland Security (2008) set out their interconnected principles for the management of resources, which includes the planning and identification of resources, the establishment of agreements and ordering of resources and their subsequent grouping. Along with this NIMS includes guidelines for the effective management of resources which consist of a need for effective information management and sets out a protocol for the ordering, mobilisation and demobilisation of resources. Boin and Hart (2010) reinforce this, highlighting that the mobilising and organising of resources can be demanding at the operational or tactical level of an emergency response where effective and efficient deployment of resources is necessary.

Homeland Security (2008) recommends that consideration is given to a number of specific system characteristics:

- interoperability and compatibility of all necessary systems;
- the capacity to organise resources by category, kind, type, skill, or any other relevant feature;
- comprehensive – include all stages from procurement/recruitment to stand down/debrief of all key resources;
- allow for the setting of system restock levels;
- provide a dynamic inventory of all available resources;
- generate high quality data outputs and information to support effective decision making;
- include provision for ongoing training and exercising of the system;
- be flexible enough to use during "normal" and "emergency" operations;
- represent good value for money.

Ongoing tracking of resources can be used to collect accurate and timely information, support decision making and help provide for ongoing accountability during an operation. Perry (2003), when discussing accountability, suggests that human resources in particular should be tracked in order to monitor their safety. Kapucu, Arslan and Demiroz (2010) suggest that tracking via a geographic information system (GIS) can also provide emergency management professionals with a flexibility that allows for "situational awareness tools to identify, activate, track, and coordinate response assets" (p.462). Dymon (1990 cited in Cova 1999) suggested that GIS be used to map and coordinate the flow of resources both throughout and after an emergency. Gunes and Kovel (2000) propose that a GIS data based system be used to collect and display information such as **"**location, contact information, and relevant skills and/or experience of potential disaster response personnel" and that this "improves deployment by keeping a running log of each member's latest action, shift, and availability" (p.138). This information may be logged not only for human resources but also for supplies, equipment and vehicles.

RMS must be flexible and function based so that they can gather the required level of information on resources (Perry 2003). Bigley and Roberts (2001) also highlight the importance of flexibility, but recognise that there is also a need to define and set standard procedures and guidelines. Similarly, Turoff et al. (2004) recommend that a system should not be designed to a set of emergency scenarios, like fires, bombings etc. Such systems must have flexible functionality as an important component. Turoff et al. (2004) highlight that RMS for use during an emergency must be capable of use in non-ideal or challenging settings - such as being used on extremely limited size screens. Furthermore, it is important to ensure that systems have both online and offline features and that due consideration is given to reliability, cost, and security (Ozguven and Ozbay, 2013).

The literature suggests that accuracy, reliability and flexibility are important system characteristics essential to the successful operation of a RMS in an emergency context.

Bigley and Roberts (2001, p.1283) underline the need for these three variables by highlighting the complexity of major emergencies:

> Consider the account of the rapid coordination by the IGS of diverse resources in response to an immense California fire. The event spanned ten days, and the fire was fought under volatile conditions both over treacherous or difficult-to-access wildlands and in various residential areas. From the outset, resource deployment proceeded at a torrid pace. Three minutes after the first call was received, approximately 65 people, 7 engine companies, 2 water-dropping helicopters, and 1 bulldozer were dispatched to the scene. Within 80 minutes, the deployment had escalated to over 950 people and several hundred pieces of equipment. In the end, approximately 839 engines and 44 aerial units (consisting of both helicopters and fixed-wing aircraft) were called into service. Firefighters responded from 458 fire agencies across 12 states and ultimately numbered more than 7,000.

Pettit and Beresford (2006) set out a list of 10 critical success factors for humanitarian supply chains. Of most relevance are: planning and collaboration; inventory management; information management; human resource management; and performance indicators. Van Wassenhove (2006) similarly highlights that there are a number key elements needed for effective preparedness - human and financial resources, knowledge, procedures, and process management. For an organisation to build on its capabilities in response to any given emergency is also necessary to focus on human and technical resources, including their mobilisation and having a logistic and information management system(s) (Kusumasari, Alam and Siddiqui 2010). Furthermore, Miao, Banister and Tang (2013) note that key to delivering resilience is the need to build flexibility, agility, speed and accuracy in any response.

Emergency response, from a logistics perspective, involves “mobilizing people, materials, skills and knowledge to help vulnerable people affected by disaster” (Van Wassenhove 2006, p.476). “Time is clearly one of the crucial factors in any emergency relief operation. It is important for the stocks to arrive in the right area at the right time in order to assist the victims” (Pettit and Beresford 2006 p.456). As a result a fundamental difference between general RMS and those used during/for emergencies is that “the time values of commodities are much greater than the inventory carrying costs”

(Long and Wood, 1995 cited by Pettit and Beresford 2006 p.456).

Turoff et al (2004) set out a number of useful requirements designed to improve response times. RMS should be: easy to learn, understand and use; include a high degree of customisation; and should not only be limited to use during an emergency. Pettit and Beresford (2006) further highlight that access to trained personnel is vital during an emergency and that human resource management in this context is about getting the "right people […], in the right place […] as soon as possible […]" (Pettit and Beresford 2006, p.459). As a result, it is advantageous that RMS include the capacity to catalogue human resources by type, logging qualifications and certification ('HSPD-5' cited by Annelli 2006). Furthermore, with regard to other resources, tracking and reporting can also log and track maintenance records, and log its current status and location (Turoff et al 2004).

Miao, Banister and Tang (2013) advocate the use of supply chain alliances to boost response capacity and capability. To take advantage of such alliances, considerable effort, planning and training is needed in order to build interoperability between participants. Interoperability should allow resources from multiple public, private and non-profit organisations to come together to enhance response and recovery operations. As noted by Kapucu, Arslan and Demiroz (2010) interoperability involves determining how resources from different organisations can work together and interact with each other. As part of the preparedness and response phases, Chen et al. (2008) recommend the use of cross organisational "resource readiness management, […] resource deployment and usage priority schemes, guidelines, resource standardization, mutual aid, donor assistance, inventorying" (p.69) along with the establishment of appropriate resource recovery and maintenance plans. Wang et al (2014) suggest that organisations use network mapping to attain optimum resource allocation during an emergency. Shen and Shaw (2004) also support this idea, noting that information management systems within emergency management may be used to prioritise allocation of resources and support decision makers. One example they give is dynamic resource allocation, where a "resource inventory database […] is constantly updated and

linked to decision support applications" (Shen and Shaw 2004, p.2119).

The importance of getting the right information is also emphasised by Yates and Paquette (2011, p.7). When discussing information management systems they note that the use of specialist software can allow users to organise information into easy to access data packets suggesting it makes it "much easier to gather 'the right information' especially when it arrives piecemeal and from a variety of sources". For example, such systems may include separate streams for tracking relief supplies and for locating missing persons. While getting information into these functional areas can be a laborious process, making use of that information to make decisions is often even more manually intensive."

Theoretical Framework and Methodology

The literature review revealed that relevant resources in an emergency management context include three broad categories: People; Equipment; and Supplies/Consumables.

With regard to people, it was felt that a comprehensive RMS should provide:

- A list of all personnel;
- Contact details for each person;
- The experience of each person;
- The expiry dates for certain types of training;
- The qualifications of each person;
- The skills set of each person;
- The ability to track the location of each person;
- The availability of each person (Current);
- The availability of each person (Projected/Expected);
- The training record for each person.

For equipment (including transport, technology) an effective RMS should make available:

- Current location;
- Equipment cost/value;
- List of equipment;
- List of lost and unserviceable equipment;
- Maintenance schedule;
- Register of available equipment;
- Repairs due;
- The ability to track the current location of equipment;
- Usage logs.

Finally, with regard to supplies and consumables, a RMS should provide:

- A list of all supplies/consumables;
- Location of supplies/consumables;
- Stock levels of supplies/consumables;
- Usage logs of supplies/consumables;
- Cost/value of supplies/consumables.

With regard to the characteristics of the actual system, the following were deemed most significant:

- Ability to generate high quality outputs - statistics, reports etc.;
- Accuracy;
- Capacity and capability to manage all types of resources in one system;
- Cost;
- Ease of access - off site;
- Ease of access - on site;
- Ease of use;
- Flexibility;
- Interoperability;
- Level of security;
- Reliability.

The data for this study was collected via an online questionnaire based around the theoretical framework summarised above. The questionnaire was sent, via email and Twitter, to over 500 emergency management professionals across the globe. To maximize the reach of the questionnaire, a cascading method of dissemination was employed where the professionals contacted were asked not to only complete the questionnaire but to share it with their own network and contacts in other organisations.

A title page was embedded within the survey. It noted that the questions related to the topic of resource management and that they were intended for personnel involved in emergency management. Within the survey, respondents were asked to select the 'type' of organisation in which they worked from a list of 12 options, including an 'other' category - which allowed respondents to identify their organisation type.

The questionnaire was first piloted on a small sample of emergency managers and then distributed using an online survey platform. The data was analysed using SPSS21 (the IBM statistical analytics software).

A total of 352 responses were collected from respondents in the USA (32.10%), Ireland (21.88%), Canada 15.63%), the UK (7.95%), New Zealand (6.53%), Australia (3.98%) and the rest of the world (11.93%). Respondents were categorised across six organisational types. The Emergency Services represented 29.83% of respondents, Voluntary and NGOs 26.99%, Private Sector 22.73%, Local Government 9.94%, Semi-State and Public Sector 5.97%, and National and State Government 4.55%.

It should be noted that the term 'system' is not used solely to describe a technological system rather it is used to describe any work system where "human

participants and/or machines perform business processes using information, technologies, and other resources to produce products and/or services for internal or external customers" (Alter 2002, p.5).

Findings

The following section examines the RMS currently in use within the organisations surveyed; the types of resources and information tracked by these systems; and the overall importance of certain elements and characteristics of these RMS.

Analysis of Current Resource Management Systems Deployed

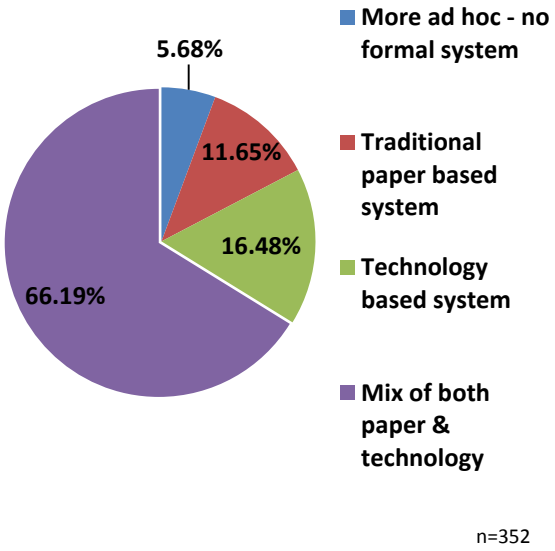


Figure 1: Current Mode – Paper or Technology Based

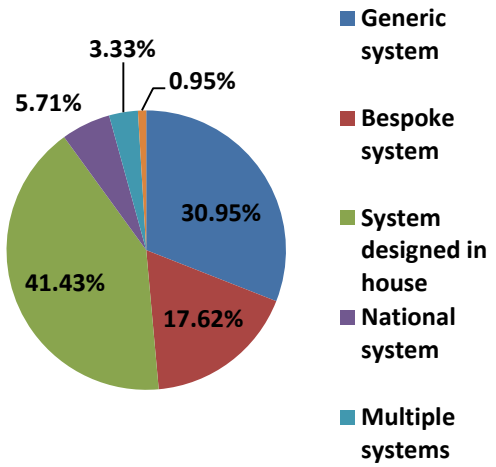
Figure one details the use of paper versus technology based systems by all respondents. The majority of respondents (66.19%) use a mix of both paper and technology to manage their resources. Only 17.33% of respondents (61 out of 352) use either no formal system or one based solely on paper. 82.67% of respondents (291 respondents out of 352) employ a technology based RMS. When this data is broken down by organisational type, two points are worthy of note.

1. While 5.68% of all organisations surveyed had no formal system, this rose to 10% for private sector respondents.
2. The use of technology based systems rose from 16.48% across all organisations to 24.2% for voluntary and NGO respondents.

To further explore the type of RMS in use, respondents were presented with a further breakdown of options for the type of systems in use – see Figure 2. Respondents were also free to describe their own system rather than selecting one of the pre-set options. The data shows that 41.43% of respondents use a system designed within their organisation, 30.95% use a generic RMS, and 17.62% use a bespoke RMS. A number of

respondents (5.71%) noted that their system was based on a national system such as NIMS.

When this data is analysed further it emerges that a generic system is used by 30.95% of all organisations, but this rises to 44.1% for voluntary and NGO respondents and decreases to 21.7% for private sector organisations. The percentage using a system designed in house rises to 50%, from an overall figure of 41.43%, for the private sector and decreases to 30.9% for voluntary organisations and NGOs.



n=352

Figure 2: Types of Emergency Resource Management System

Resources Managed Using Resource Management Systems

Following on from establishing the type of systems respondents are using, it was necessary to identify what resources respondents managed within their RMS. However, not all respondents were directed to this section of the questionnaire. Those who indicated that they had 'no formal system', a total of 20 respondents, automatically skipped part two of the questionnaire. An additional 122 people chose to skip this section or end the survey early.

Drawn from the literature, five resource categories which respondents could manage within their system were identified. These were: People; Transport; Equipment; Supplies/Consumables; and Information. Respondents could also suggest further resources that suited their work environment. Table 1 details the types of resources that the respondents managed within their RMS.

Resource	%	n=
People	95.3%	201
Equipment	82.0%	173
Information	68.7%	145
Supplies/Consumables	55.9%	118
Transport	55.0%	116
Other	8.5%	18
Skipped Q.	0.5%	01
TOTAL		211

Table 1: Resources Managed in RMS

People (95.3%) and Equipment (82%) were the top two resources managed within a RMS – followed by Information which was included in 68.7% of systems. Deeper analysis of the results revealed that a smaller percentage of emergency service organisations (58%) managed information within their system.

More than half of the organisations surveyed managed Supplies/Consumables (55.9%) and Transport (55%) using a RMS. However, only 39.7% of Voluntary groups and NGOs managed Transport and 42.6% of these organisations managed Supplies/Consumables using such a system. On the other hand the private sector (63%) and emergency services (62%) are more likely to operate such a system for the management of Transport resources. Furthermore, there is extensive use of a RMS to track Supplies/Consumables within private sector organisations – 67.4% reported that their RMS was used to manage these resources.

Respondents were then asked follow-up questions regarding the specific types of information they recorded within their system for: Human Resources; Equipment; and Supplies/Consumables.

Based on the results, respondents were most likely to collect information related to Human Resources followed by Equipment and Supplies/Consumables.

HR Information Held on RMS	%	n=
List of personnel	93.8%	197
Contact details	86.7%	182
Training record	64.3%	135
Qualifications	63.3%	133
Skills sets	59.0%	124
Expiry dates for training	59.0%	124
Availability (Current)	52.9%	111
Availability (Projected/Expected)	40.0%	84
Experience	34.8%	73
Current location (Track)	21.0%	44
None of the above	5.2%	11

Table 2: Human Resource Information on RMS

With regards to Human Resources, the vast majority of organisations (93.8%) record a list of personnel on their RMS, with 86.7% of respondents also recording the contact details for each person. This represents the core Human Resource related data held on the RMS. A significant number of organisations went on to use the system to track training records (64.3%), qualifications (63.3%), expiry dates of training (59%), and the

skills set of personnel (59%). Just over half of respondents monitor the current availability of personnel (52.9%), and fewer still, 40%, monitor their projected or expected availability. The experience and current location (tracking of personnel) were less likely to be monitored via the RMS. Even though they reported use of a RMS, 5.2% of respondents stated that they did not track any of the ten categories of information regarding human resources on their system.

Equipment Information Recorded on RMS	%	n=
List of equipment	83.7%	174
Current location	60.6%	126
Maintenance schedule	48.1%	100
Register of available equipment	47.6%	99
Repairs due	39.9%	83
Usage logs	38.9%	81
Equipment cost/value	34.6%	72
List of lost and unserviceable equipment	31.7%	66
The ability to track the current location of equipment	31.3%	65
None of the above	10.1%	21

Table 3: Equipment Information on RMS

Progressing on to equipment (including transport), apart from a list of equipment at 82.6%, the only other category of information that was tracked by more than 50% of respondents was the current location (60.6%) of the equipment. The data for the remaining 7 are outlined in the Table 3 above. In addition, 9.7% of respondents reported that they did not record any of given information for equipment.

Supplies/Consumables Information on RMS	%	n=
List of all supplies/consumables	50.00 %	100
Location	45.50 %	91
Quantity levels	38.00 %	76
Cost/Value	31.50 %	63
Usage logs	28.00 %	56
Expiry dates	26.50 %	53
None of the above	38.50 %	77

Table 4: Supplies/Consumables Information on RMS

Supplies and consumables are the least monitored resources, with 38.5% of respondents reporting that they did not track or record any of the information outlined above. Half of respondents stated that they did keep a list of all

supplies/consumables on their RMS – with 45.5% also logging the location of these supplies. Over 30% of respondents monitored quantity levels and the cost/value of supplies and consumables and less than 30% complete usage logs and record expiry dates.

Learning From Experience

A critical element of effective emergency management is the need to learn from past experience. Respondents were asked if their RMS system included a facility to capture specific information regarding previous emergencies and an option to record a review of how well such events were managed. Most respondents reported that their RMS did include the capability to record these details (see Figures 3 and 4).

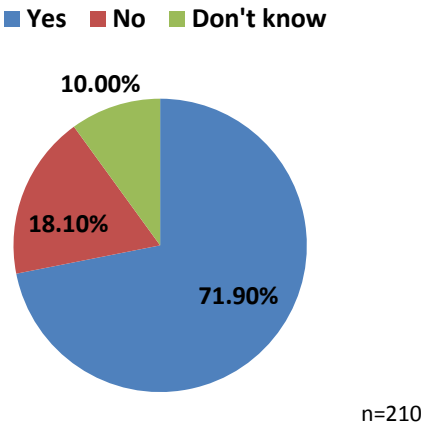


Figure 3: Facility to record details of past emergencies

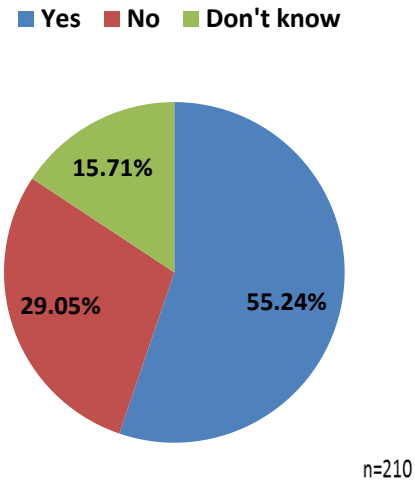


Figure 4: Facility to record a review of past emergencies

71.9% of those surveyed confirmed that their RMS allowed for the recording of details of past emergencies, with a further 55.24% stating that post emergency their system also facilitated the uploading of a review of response. Private sector organisations reported greater use of systems with this facility. 67.4% of private sector respondents used a RMS which allowed for the upload of a review.

Satisfaction with Current Resource Management Systems

This section examines the level of satisfaction with current RMS with particular emphasis on the relative importance of the components and

characteristics identified during the literature review.

On a scale of one to five, from extremely dissatisfied (1) to extremely satisfied (5), respondents were asked how satisfied they were with the overall effectiveness of their system. The results are displayed in Figure 5. In general, respondents were neither extremely satisfied nor dissatisfied with their system – with a mean satisfaction score of 3.32. Overall, 44.66% reported a satisfaction score of 4 or 5 with their system while 22.83% were not entirely satisfied, and rated their satisfaction as 1 or 2.

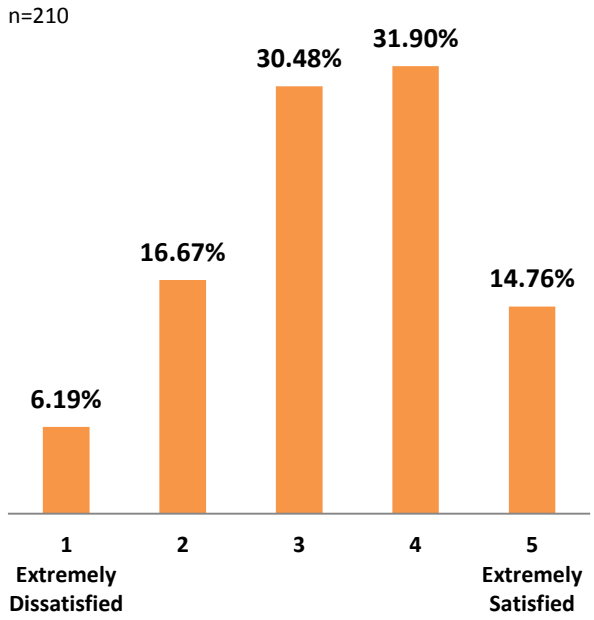


Figure 5: Overall Satisfaction with current RMS

To investigate this further, respondents' satisfaction was cross referenced to the type of system they were using. Those who used a technology based system were most satisfied (with 74.3% of respondents rating their satisfaction as 4 or 5). In contrast, only 45.9% of those who used a mix of paper and technology and only 17.2% of those who used a paper based system recorded a 4 or 5 satisfaction rating.

Of the respondents who used a generic system, 56.9% rated their overall satisfaction with the RMS at 4 or 5. For those who used a bespoke system, a marginally higher percentage (59.5%) rated their satisfaction at 4 or 5. Only 28.7% of those using a system designed in house rated their system as an overall 4 or 5 on the satisfaction scale.

In addition to respondents overall satisfaction with their RMS, it was essential to identify the relative importance of each element or function of the system. Respondents were asked this with regard to human resources, equipment, and supplies/consumables. Again a five point scale was used, with 1 indicating a function of little importance, and 5 indicating a function of vital

importance. A mean value was then calculated for each function (see Table 5).

Focusing in on the data displayed in Table 5, all ten functions were rated as being of above average importance (all scored above 3). In terms of relative importance, the top three functions required from a RMS with regard to human resources were: (1) A list of all personnel; (2) Contact details for each person; and (3) The current availability of each person. The ability to track the location of each person was ranked lowest at number 10, yet it should be noted that it still had a mean value of 3.58.

Ranked Order		Mean	n=
1	A list of all personnel	4.77	206
2	Contact details for each person	4.74	206
3	The availability of each person (Current)	4.39	206
4	The skills set of each person	4.25	205
5	The qualifications of each person	4.13	205
6	The availability of each person (Projected/Expected)	4.11	205
7	The training record for each person	4.02	205
8	The expiry dates for certain types of training	3.96	205
9	The experience of each person	3.94	205
10	The ability to track the location of each person	3.58	205

Table 5: HR: Importance of RMS Functions

With regard to equipment, the results show that once again all functions were rated as being of above average importance (Table 6). In terms of relative importance, the top three functions required from a RMS with regard to equipment were: (1) a list of all equipment; (2) the availability of equipment; and (3) the current location of equipment. The recording of the

cost/value of equipment was rated as being of least importance, yet it still achieved a rating of 3.29 out of 5.

Ranked Order		Mean	n=
1	A list of all equipment	4.58	206
2	The availability of equipment	4.50	205
3	The current location of equipment	4.35	206
4	The current condition of equipment	4.33	206
5	The ability to track the location of equipment	4.20	206
6	Repairs due to equipment	3.93	206
7	A maintenance schedule for equipment	3.83	206
8	Usage logs for equipment	3.69	206
9	Details of lost, retired and unserviceable equipment	3.35	206
10	Cost/value of equipment	3.29	206

Table 6: Equipment: Importance of RMS Functions

Finally, with regard to supplies and consumables, the results show that once again all functions were rated as being of above average importance (Table 7). In terms of functionality the most important requirement was need for a list of all supplies/consumables and, of joint second importance, the need to track the location of supplies/consumables and the maintenance of accurate data on stock levels.

Ranked Order		Mean	n=
1	A list of all supplies/consumables	4.00	206
2	Location of supplies/consumables	3.89	206
3	Stock levels of supplies/consumables	3.89	206
4	Usage logs of supplies/consumables	3.37	206
5	Cost/value of supplies/consumables	3.18	206

Table 7: Supplies/Consumables: Importance of RMS Functions

Following the ranking of the importance of various RMS functions, respondents were then shown a list of 11 system characteristics and were again asked to rank these based on importance, on a scale of 1 to 5. Overall, these characteristics were valued highly by respondents (see Table 8). All eleven were rated as being of higher than average importance – will all scoring above the mid value of 3. The top five system characteristics, all with a mean score of more than 4.5 were: reliability;

ease of use; ease of access - on site; accuracy; and ease of access - off site. Cost, the only characteristics with a mean score of less than 4, was the lowest ranking variable.

Ranked Order		Mean	n=
1	Reliability	4.74	206
2	Ease of use	4.70	206
3	Ease of access - on site	4.64	206
4	Accuracy	4.62	206
5	Ease of access - off site	4.51	206
6	Flexibility	4.32	206
7	Capacity & capability to manage all types of resources in one system	4.28	206
8	Level of security	4.25	206
9	Interoperability	4.12	206
10	Ability to generate high quality outputs: statistics, reports etc.	4.00	206
11	Cost	3.96	206

Table 8: The Importance of RMS Characteristics

Conclusion

It is clear that organisations require and value the ability to generate a list of all personnel and their contact details. Not surprisingly, therefore, 93.8% of organisations used a RMS with the capacity to generate such a list and 86.7% logged contact details for all personnel on their system. However the ability to track the current availability of each person, while ranking third highest in terms of importance, was only available to 40% of respondents within their current RMS.

With regard to equipment, the generation of a list of equipment was considered the most important function of a RMS and 83.7% used a system which provided such an inventory. However, the function listed as being of next most importance, a register indicating current availability of equipment, only existed in 47.6% of the organisations surveyed. The ability to track the location of equipment received a score of 4.2 out of 5 with regard to importance, nevertheless only 31.3% of respondents had this information available to then via their current RMS.

Similarly, for supplies/consumables, the basic requirement to produce a list of all these resources was ranked as the most important function of the RMS - yet this was only possible in 49.5% of the organisations surveyed.

It is clear that there are gaps between the functions rated as being of vital importance and what is currently available to those responsible for emergency

management in the organisations surveyed. However, there is a significantly higher level of overall satisfaction among those who used a technology based system (with 74.3% of respondents rating their satisfaction as 4 or 5) and those who use a paper based RMS (17.2% recorded a satisfaction rating of 4 or 5).

With a view to improving the systems currently in use, respondents were asked how their RMS could be improved. A total of 109 suggestions were received. Using the analysis software Nvivo-10 a word cloud was formed – see Figure 6 below.

Figure 6: Suggested RMS Improvements

From all the individual responses received, and based on research completed for this study, six recommendations are worthy of consideration:

1. All-in-one, flexible systems – there is much to be gained from implementing one system which may be used to list, track and monitor all resources.
2. Recording and analysing past incidents – RMS should facilitate the retention of knowledge within an organisation by including a reporting system which allows for the recording of key decisions made during an emergency or training session and permits reflection on the quality of these decisions as well as the overall quality of the response. Particular emphasis should be given to how well resources were allocated, utilised, replenished and recovered.
3. Given the significant advances in (and familiarity with) mobile technology, many respondents encouraged the development of a mobile APP (for phones and tablets) which could be used in the field. Failing this, allowing for a user friendly, tablet-based interface would encourage greater and more effective use of the RMS during the response phase of an emergency.

4. Better or more sophisticated tracking – which makes use of barcode and GPS technology – should be integrated into RMS.
5. Easy to use – complexity appears to be the enemy. Respondents want easy to use, intuitive technology and systems.
6. Closely linked to ease of use, the importance of better and appropriately pitched training, user friendly manuals, and online tutorials for all RMS users cannot be overstated.

Glossary

Bespoke System	A resource management system that has been specially designed/made for a particular customer/organisation.
Generic System	A resource management system that has been designed to meet the needs of a wide range of organisations - sometimes referred to as 'off-the shelf'.
IMS	Incident Management System - refers to a standardised process used to manage a crisis or emergency..
Mean	The technical definition of 'average' is the arithmetic mean: calculated by adding up the values and then dividing by the number of values.
n	Used to denote the total count. In this case the number of respondents who replied to a specific question – this value is given within all figures and tables.
National System	A Resource Management System modelled on, or following, the principles laid out in A Framework for Major Emergency Management, 2006.
NGOs	Non-governmental organisations
NIMS	The US National Incident Management System
RMS	Resource Management System refers to a system used to manage resources and processes – in this case within the context of emergency management

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To Cite This Document

McMullan, C. and Brown, G.D. 2016. *Enhancing Emergency Preparedness through Effective Resource Management.* DCU Business School, Dublin.