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| Institution: Aston University |
| Unit of Assessment: 19 Business and Management Studies |
| Title of case study: Employing Operational Research and Social Marketing to improve emergency preparedness |
| <p>1. Summary of the impact (indicative maximum 100 words)</p> <p>Research carried out at Aston University into the use of Operational Research and Social Marketing techniques to optimize the creation, implementation and evaluation of preparedness for different types of emergency, has led to impacts at local, national and international level. This research has:</p> <ul style="list-style-type: none"> • Influenced and changed the way in which government agencies deal with mass decontamination following a CBRN (Chemical, Biological, Radiological or Nuclear) incident. • Influenced the decision process for allocation of resources to respond to terrorist attacks and natural disasters. • Increased understanding and changed policy and the creation process for plans regarding preparedness for mass evacuation for government organisations. |
| <p>2. Underpinning research (indicative maximum 500 words)</p> <p>As a reaction to terrorist attacks (in New York, London, Madrid, Mumbai amongst others) and the scale of natural disasters (such as the tsunami in Japan in 2011, flooding in Pakistan, fires in Australia and volcanic eruption in Iceland), policy makers have become increasingly interested in disaster management.</p> <p>This impact case study demonstrates the use of Operational Research techniques for the creation, implementation and evaluation of preparedness plans for emergency response. This research was carried under the umbrella of the Aston Centre for Research into Safety and Security (CRISIS). For the purposes of this case study our research focuses on the applications of operational research and social marketing to two scenarios:</p> <ul style="list-style-type: none"> • Emergency response to terrorist attacks and • Evacuation Responsiveness for Government Organisations (ERGO). <p>Response to terrorist attacks</p> <p>The first application was developed from November 2004 to May 2005 for the then Office of the Deputy Prime Minister and the Fire and Rescue Service (ODPM/FRS) within the United Kingdom, who commissioned the research. The ODPM/FRS research provided two simulation models to help the Fire and Rescue Service understand how it allocates resources before an incident, and how to best respond to multiple events (ref 3.1).</p> <p>The first model dealt with mass decontamination of a population following the release of a hazardous substance – studying resource requirements needed to meet performance targets. The second model dealt with the allocation of resources across regions – studying cover level and response times, analysing different allocations of resources, both centralized and decentralized. This research was carried out by Pavel Albores and Duncan Shaw.</p> <p>Mass evacuation</p> <p>The second application relates to a European Commission (EC) funded project, <i>Evacuation Responsiveness by Government Organisations (ERGO): A Preparedness Toolkit for Europe</i> Refs 3.2, 3.6 and 3.8. This was a three-year project, running from 2008 to 2011, which focused on understanding how governments prepare for mass evacuations (i.e. evacuations of cities or parts of cities, rather than buildings or stadia). Ten countries participated in the research: the UK, Belgium, Poland, Bulgaria, Germany, Sweden, Denmark, Spain, Iceland and Japan. The collaborators were all at senior level, for example directors of civil protection at national or regional level. The work had three main streams:</p> |

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- Modelling and simulation. The key issue in this stream was to improve the computer models that are used by government organisations to prepare for mass evacuations (**Ref 3.3**).
- Preparing the public. How to best prepare the public to respond to evacuations (**Ref 3.4**)
- Making the evacuation decision. What factors should be taken into consideration when calling an evacuation? (**Ref 3.5**)

An evacuation preparedness model was proposed (Figure1) and best practices, as well as models, materials and frameworks were developed for each step.

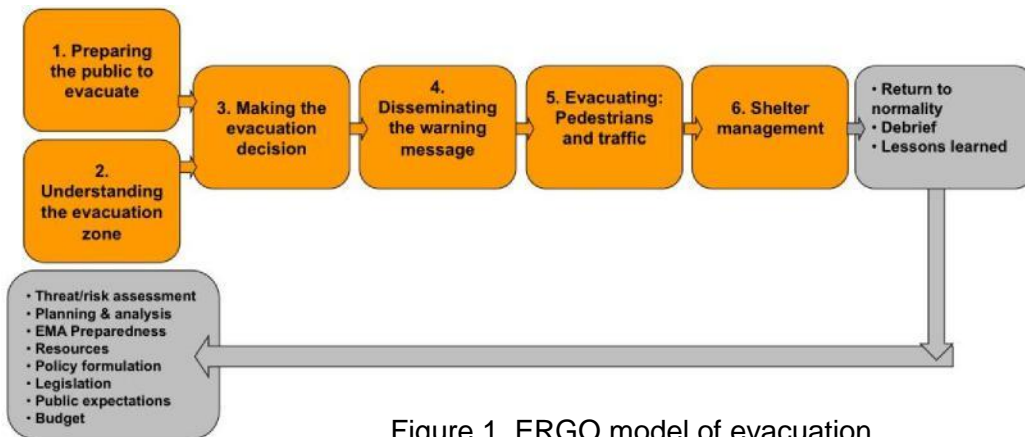


Figure 1. ERGO model of evacuation.

As a further outcome of the research, the team constructed the Evacuation Preparedness Assessment Workbook (EPAW) (**Ref 3.6**), detailing the best practices for each step. This is a tool for emergency managers to prepare their organisation for mass evacuations. It encompasses each of the six stages covered in the ERGO Framework for Evacuation and provides a systematic method for emergency managers to evaluate each part of their approach to preparedness.

This work was carried out by Duncan Shaw, Pavel Albores and Patrick Tissington.
 Duncan Shaw (Lecturer 2001-2004; Senior Lecturer 2004-2008; Professor 2008-2012)
 Pavel Albores (Research Fellow 2004-2007; Lecturer 2007- present).
 Patrick Tissington (Lecturer 2003-2008; Senior Lecturer 2008-2011; Reader 2011-2013).

3. References to the research (indicative maximum of six references)

3.1 Albores, P. and Shaw, D., 2008 "Government preparedness: Using simulation to prepare for a terrorist incident " Computers and Operational Research, vol. 35, pp. 1924-1943. Copy available on request.

3.2 Shaw D, Albores P, Anson S, Kailiponi P, Nagarajan M, Tissington P and Hart T (2011) Evacuation Responsiveness by Government Organisations (ERGO): Final Report. Birmingham, UK ISBN 978 1 85449 486 3. Copy available on request.

3.3 Nagarajan, M., Shaw, D. and Albores. P. 2012 Disseminating a warning message to evacuate: A simulation study of the behaviour of neighbours, European Journal of Operations Research Vol. 220 Issue 3 pp. 810-819 <http://dx.doi.org/10.1016/j.ejor.2012.02.026>

3.4 Anson S, Shaw D and Tissington, P (2010), "Social Marketing for Evacuation Preparedness". Academy of Marketing Conference, Coventry, 5-7 July 2010. Copy available on request.

3.5 Kailiponi,P., (2009), Analyzing evacuation decisions using multi-attribute utility theory (MAUT), *Proceedings of the First International Conference on Evacuation Modeling and Management (ICEM)*, Delft, NL. Copy available on request.

3.6 Shaw D, Albores P, Anson S, Kailiponi P, Nagarajan M, and Tissington P (2011) Evacuation Responsiveness by Government Organisations (ERGO): Evacuation Preparedness Assessment Workbook (EPAW). Birmingham,ISBN 978 1 85449 4917. Copy

Impact case study (REF3b)

available on request.

Grants:

3.7 Albores P, Shaw D (2004) Modelling of emergency response to terrorism (Mass Decontamination and resource allocation) *Funded by the Office of the Deputy Prime Minister (ODPM) and Fire and Rescue service* Amount of grant £30,000.00 Duration: 6 Months

3.8 Shaw D, Albores P, and Tissington P (2008-2011) Evacuation Responsiveness by Government Organisations (ERGO): A Preparedness Toolkit for Europe JLS/2007/CIPS/025. *Funded by the EC -Directorate-General Justice Freedom and Security (now DG-Home Affairs).* Amount of grant: € 440,000.00. Duration: 36 Months

References 3.1 and 3.3 are peer reviewed journals of good quality (5 year citation index: 2.374 and 2.524 respectively). References 3.2 and 3.6 are official reports submitted to the EC and evaluated as output of ERGO. References 3.4 and 3.5 are peer-reviewed conference papers, 3.4 in the premier conference on its area in the UK. Reference 3.8 was a competitively awarded grant obtained after a thorough evaluation of the quality of the research by the EC.

4. Details of the impact (indicative maximum 750 words)

The impact of the Aston CRISIS Centre's research has been demonstrated at local (Lincoln), regional (Queensland, Australia, Flanders, BE) and national (UK) level. This research has:

- Influenced and changed the way in which government agencies deal with mass decontamination following a CBRN incident.
- Influenced the decision process for allocation of resources to respond to terrorist attacks and natural disasters.
- Increased understanding and changed policy and the creation process for plans regarding preparedness for mass evacuation.

Response to terrorist attacks

This research was used by the UK Fire and Rescue Service (FRS) in its strategic planning as part of the New Dimension Programme to respond to natural and man-made disasters (**Ref 5.1**). The Fire Service used the models (**Ref 3.1**) to evaluate different resource allocation strategies and effectiveness of the response to incidents and planning assumptions, across the country and whether to centralise or decentralise these resources, increasing the awareness, capacity and performance of the FRS to respond to large-scale disasters. These models were used until 2009 (**Ref 5.3**). Those changes remain in place to this date.

Our research (**Ref 3.1**) has also changed the process through which mass decontamination plans are created and evaluated, not only for the FRS but other agencies as well, as evidenced in the ORCHIDS (Evaluation, optimisation, trialling and modelling of procedures for mass casualty decontamination) report by the UK Health Protection Agency (HPA) (**Ref 5.2**). The HPA's report mentions: "As a result of training and operational experience, the mass decontamination procedures have changed... since, and also ... due to, the work of Albores & Shaw (2008)" (**Ref 5.2**).

The Australian Government has used these models to inform emergency response to CBRN attacks (2008) and increase awareness in the "Disposition of current resources and the linkages from a specific location to regional, state and national [levels], Comparing levels of preparedness against service delivery options, applying the models in at least two states... to allow comparative studies and build a national situational awareness." (**Ref 5.4**)

Mass evacuation

ERGO research (**Refs 3.2-3.6**) has changed the way in which policies are set at different levels of government. For example, the Lincolnshire Local Resilience Forum (LRF), mentioned:

"This research (**Ref 3.6**) conducted by Aston University CRISIS Centre, identifies how vulnerable people can be supported in their evacuation preparations in case of a flood...producing a series of recommendations which centred on providing better information to the public (e.g. evacuation routes, encouraging effective two-way communication between residents and officials, and conducting practice evacuations from floods." (**Ref 5.5**) pp.30

Following the implementation of the recommendations, including the targeted information campaign, the attitudes, awareness and behaviour of the population changed:

“The number of people who said they felt quite or very prepared for flooding increased from 39.7% to 49.3%, but importantly, the results showed that more people had actually taken action.” (Ref 5.5) pp. 26

The same report, when presenting the work done by Aston (Ref 3.2)3.2, highlights the benefits in response capability: *“The following key innovations, research and good practice from the programme are highlighted not only because they make a significant contribution to the 7 ECIG (East Coast Inundation Group) outcomes, but they also contribute to the wider UK capabilities programme.” (Ref 5.5) pp. 24.*

Another example of the impact of the ERGO research is the use of the EPAW (Ref 3.6) as an audit tool and benchmark against which to evaluate current procedures. This evidence is presented in the UK Department for Communities and Local Government (DCLG) resilience newsletter (Ref 5.6).

“Lincolnshire LRF undertook a comprehensive process to assess their preparedness for mass evacuation in the event of coastal flood. They used work developed by Aston University ... to identify and prioritise future partnership work to close any remaining gaps in the LRF’s capabilities and capacity to do so... Lincolnshire LRF reviewed their policies, plans and structures with category 1 and 2 responders and discussed how they stood up to the standards as defined by ERGO... Lincolnshire LRF recommend this approach to local resilience forums, as the external standards as defined in ERGO are an excellent reference point ...” (Ref 5.6) pg. 9 (This impact occurred in 2011-2012)

Social marketing campaigns around nuclear installations in the region of Flanders, Belgium were redesigned as a direct result of this research (Ref 5.6). (Impact occurred 2011-2012)

The project team is working with the British Standards Institute and are involved with the International Standards Organisation (ISO) to develop a Standard for preparing for mass evacuation (Ref 5.7). This directly builds on the ERGO Project research and the Standard is being based to a large extent on our findings (Refs 3.2-3.6) as shown by the similarities between Figure 1 above and Figure 1 in the Standard. (Impact 2011-2013).

5. Sources to corroborate the impact (indicative maximum of 10 references)

- 5.1 National Audit office (2008) New Dimension – enhancing the Fire and Rescue Services’ capacity to respond to terrorist and other large-scale incidents
- 5.2 Amlot, R et al, (2011) Evaluation, optimisation, trialling and modelling of procedures for mass casualty decontamination (ORCHIDS) Final Report for implementation phase 01/06/2008 to 30/05/2011, Health Protection Agency, Emergency Response Department (ERD) Porton Down, Salisbury
- 5.3 Head of Resilience Research Branch, DCLG, UK. , (2013) Correspondence
- 5.4 Director, Emergency Management Australia, Attorney-General Department, Australian Government (2007-8) Email communication trail.
- 5.5 Lincolnshire Resilience Forum, (2011). Using Coastal flooding in Lincolnshire as ‘A programme for change’ Report by the LRF
- 5.6 REDistribute (2012) The DCLG (Department of Communities and Local Government) Resilience and Emergency Division Newsletter. Issue 2 Sep 2012
- 5.7 Attaché, Directorate- General Federal Public Service of the Interior, Crisis Centre, Belgium, (2013) Support Letter.
- 5.8 International Standards Organisation, (2013) Standard ISO/DIS22315 Societal security Mass evacuation <http://bit.ly/18HbpR>