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Implicit and explicit knowledge in flood evacuations with a case study of Takamatsu, Japan

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ABSTRACT

Preparedness of communities to natural disasters is a key to mitigating more immediate impacts, whilst improving social resilience for longer-term recovery. The neighbourhood-level implicit knowledge and its association with residents' awareness, preparedness and reaction to disasters remain imperfectly understood in the literature. A multi-disciplinary research perspective is taken in this research to enhance the understanding of the role of implicit knowledge in disaster management. The methodology is based on a literature review and descriptive analysis of knowledge management, communities of practice, explicit and implicit knowledge and evacuation behaviour. A qualitative interview on implicit knowledge was designed and administered to selected community members in the Japanese city of Takamatsu where typhoons are common and coastal flooding prevalent, as demonstrated by our historical analysis from the 17th century onwards. After reviewing the current City Disaster Management Plans, we argue that both explicit and implicit information is needed to formulate more effective, local-area evacuation plans and that the land-use planning profession in Japan has an important role in disaster mitigation. Practical implications and future research directions are identified in concluding the paper.

1. Introduction

Major disasters create significant ecological disturbance, shifts in land-use and large volumes of human waste and debris. Preparedness of communities to disasters is a key to mitigating more immediate environmental impacts, whilst optimising social resilience in order to recover in the longer term [9]. An obvious component of preparedness is what to do when natural disasters strike and this entails knowledge – both from the perspective of governments and their emergency organisations who plan disaster responses and from the perspective of the community who have accumulated historical experiences in their locality of events such as floods. Governments have institutional legitimacy based on the election process whereas intrinsic legitimacy from the community to participate in disaster planning and evacuation procedures is nurtured gradually over time through accumulative collective activities based on two-way trust. It is this positive intersection of explicit knowledge (housed in the government agencies) and the implicit knowledge (owned by local communities and stakeholders) that are more likely to lead to successful outcomes in the face of emergency situations.[1]

However, despite this theory on this positive intersection of knowledge about disaster events, how communities retain implicit knowledge and use this in the face of warnings of natural disasters, and orders to evacuate by disaster management authorities, remain imperfectly understood in the disaster management literature. We argue what is problematic about the explicit information in government information kits on disaster preparedness is that they have all been developed by 'experts', are text heavy, and lack specific information associated with neighbourhood characteristics. This often triggers barriers in real emergency situations. Preparedness also includes community willingness to follow evacuation orders once government authorities issue the call to evacuate by a specified time. For example, experience from disasters in the USA demonstrates that community experiences with federal and state organisations are not altogether positive [41]. Furthermore, in New South Wales, Australia, since 1990, the State Emergency Service operational records, and observations from personnel involved in managing evacuations, suggest that those in the community complying with requests or orders to evacuate have varied

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[1] 1. For example, Sandavol and Kyle [48] explain the role that volunteers serve in New Orleans' City-Assisted Evacuation Program, a bottom-up approach, and the importance of trust. They suggest what take-away messages government planners need to consider when adopting similar programming for their regions.

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between about 15 and 95 per cent in individual flood events ([34], p. 2). In Japan, in contrast, cultural differences (higher levels of power distance and uncertainty) increase the likelihood of citizens complying with advice offered by government sources ([45], Table 1, p. 767 and p. 769). But what gives additional support to this behaviour is the high level of awareness that is based on the implicit knowledge that many Japanese people have maintained through oral tradition.

We first consider the communities of practice who produce the information kits – people who share a common professional interest (in this case disaster management). They are the custodians of explicit knowledge and are located primarily in the government sector emergency services at the national, provincial and local levels but to this we add the land-use planning profession - for reasons apparent later in the paper when we discuss the resilience of cities and communities. The second group that we consider is a community network, such as Neighbourhood Watch in New South Wales, Australia, and *Jishu-bosai-soshiki*, or neighbourhood associations in Japan [46,6] – established to allow those with less expertise in the community to interact with those communities of practice in the government sector. They are the custodians of implicit knowledge.

A multi-disciplinary research perspective is taken. The methodology is based on a literature review and descriptive analysis of knowledge management, communities of practice, explicit and implicit information and evacuation behaviour. We draw on these findings to discuss the important role of land-use planning as a mitigation tool in a world adversely affected by rising sea levels, more frequent typhoons and heavy rain (Intergovernmental Panel on Climate Change, http://www.ipcc.ch). A case study of Takamatsu, Japan, where there is a long and well-documented history of a city suffering inundation from typhoon-generated tidal waves, is based on secondary data, especially obtained from Kagawa University [31] and translated into English, fieldwork and primary data collected through qualitative interviews with community members.

The paper is organised in the following way. The definitional part of the paper distinguishes amongst data, information, explicit knowledge and implicit knowledge. This is followed by results of an international literature review on explicit knowledge on flood preparedness followed by a literature review on implicit knowledge. The next section discusses the relationship between the collection and dissemination of explicit information and communities who have their own implicit knowledge, in particular, the communication of messages to evacuate and how communities receiving the message react. The literature covered in this area includes the planning for evacuations by government authorities and reasons why some people choose to ignore these orders. In the next section, this relationship between explicit and implicit knowledge and the communication amongst parties is illustrated with a case study of Takamatsu. The role of land-use planners is introduced because through mitigation strategies, such as zoning on flood-prone land, the risk to the community can be minimised. Finally, the conclusions generalise the results from the literature reviewed and from the case study and suggest further research on knowledge management as applied to communities of practice in the disaster management space.

2. Disasters – explicit and implicit knowledge

2.1. Definitions

First, it is necessary to distinguish amongst data, information, explicit knowledge and implicit knowledge (Table 1). With particular reference to disasters, examples of data might be the magnitude of an earthquake as measured on the Richter scale, or the maximum height of a river in flood at a specified location. Information might be a warning of a potential volcanic eruption or a forecast of the peak maximum height of a river by estimated time of arrival at a particular location following heavy and prolonged rain in the catchment area. Explicit knowledge, say of a flood event, is based on the science of meteorology, engineering knowledge of rainfall and run-off and hydrological modelling to provide estimates of flood events [3]. Implicit knowledge is held by individuals or groups of individuals and is based on experience, or on oral traditions (see, for example, [7]).

2.2. International literature on explicit knowledge for flood preparedness

Flood warning systems are often regarded as the most crucial element in unlocking the manageability of floods [35]. The aim of flood warning is to inform the community of impending flood threats and to encourage them to take actions to protect life and property. Flood warning systems should be developed and operated through the total flood warning system approach, which is described in Australia under the Australian Emergency Manual Series No 21 'Flood Warning' [2]. The total flood warning system, which is consistent with the principles outlined in the National Emergency Warning Protocol, recognises that the development and communication of flood warnings requires a systems approach consisting of numerous elements including: prediction; interpretation; message construction; response; and review ([54], p. 4).

In most jurisdictions there is no shortage of information kits produced by governments on community disaster preparedness. For example, in Australia there is the *What to Do Before During & After a Flood* [16] and the national Bureau of Meteorology *Flood Preparedness Manual.* At the state government level, New South Wales has a Flood-Safe website (https://wisdom.com.au/news/nsw-ses-floodsafe-campaign) as do other jurisdictions: *Flood Ready* (Western Australia), *Preparing for Floods: The Right Tools at a Local Level* (Victoria), *Prepare for Floods: Harden Up* (Queensland). Despite this information, the Bureau of Meteorology weather forecasts, government hydrological modelling of peak river heights, and evacuation orders issued by the NSW State Emergency Service (SES)[2] some communities are caught unprepared. In Japan, there is a greater degree of conformance to official warnings to multi-hazards of flooding and no shortage of government material for the community (in Japanese). The majority of local government in Japan has published hazard map indicating risky areas of flooding and guidelines for obtaining information and evacuation. Residents are informed of their dedicated evacuation centre and regular evacuation training is provided.

In Japan, there is a comprehensive framework for addressing natural hazards, climate change and its impacts [11]. Explicit knowledge is applied in the understanding of hazards, vulnerabilities and risks and in the implementation of adaptation measures. Nevertheless, disasters do strike and the National Government Cabinet Office has issued the 'Implementation handbook for disaster resilience education at the regional level' in 2015. The handbook provides the guideline for educating people at the local level, by providing valuable hints for resolving matters of concern that arise in disaster resilience education [11].

2.3. International literature on implicit knowledge

Communities of Practice (CoPs) is a framework of concepts that has been developed to explore what happens in groups who meet to 'share a concern, a set of problems, or a passion about a topic and who deepen their knowledge and expertise in this area by interacting on an ongoing basis' ([56], p.4). Wenger et al. [56] have defined CoPs by means of three criteria. First, a Community of Practice is a joint enterprise that is defined and negotiated by its members who meet voluntarily. Secondly, it involves mutual engagement that binds members together into a social entity. Thirdly, it is characterised by a shared repertoire of

[2] In Lismore, New South Wales (a town with an estimated residential population of 45,000 in June 2016), the Wilsons River breached the town's levee in late March 2017, inundating the CBD. Extensive flooding triggering 20,000 evacuation orders in northern New South Wales many of which were ignored (Sydney Morning Herald, April 1–2, pp. 8–9).

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