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An evaluation framework for earthquake-responsive land administration

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ABSTRACT

In recent years earthquakes and their secondary hazards have claimed the largest number of lives of all large natural disasters. Some of the world's most earthquake-prone zones are also areas of high population density. The impact is magnified by vulnerability factors including non-enforcement of building codes, knowledge gaps, urban poverty and poor governance capacity to manage and reduce earthquake risks. Poor security of land tenure and property rights increases the vulnerability of people and affects their ability to respond to natural disasters.

Earthquake recovery and reconstruction provides very significant challenges for land agencies, with these challenges differing from one country to the next due to differences in the local context. Drawing on contrasting case studies in Haiti, Nepal and New Zealand this paper identifies the common post-earthquake land administration functions and challenges that may apply to many contexts. These lessons provide land agencies and other key stakeholders with a summary of the challenges an earthquake poses for land administration at different post-disaster stages. We also discuss the policy and regulatory, institutional, operational and preparedness lessons for land administration. From these lessons we propose a framework for evaluating the earthquake-responsiveness of a land administration system. This framework can be used by a land agency in an earthquake prone region, or where an earthquake has recently occurred, to assess what challenges to land administration might occur in the event of an earthquake, and the preparedness of their land administration system.

1. Introduction

In recent years earthquakes and their secondary hazards have claimed the largest number of lives of all large natural disasters. On average 50,184 people were killed every year between 2000 and 2008 due to seismic events (IFRC, 2010). The years between 2010 and 2015 have been particularly harsh reminders of this fact with earthquakes including in Chile and Haiti, the earthquake sequence in Canterbury New Zealand, the earthquake, tsunami and nuclear emergency in Japan, and the earthquake sequence in Nepal.

Some of the world's most earthquake-prone zones also have high population density, which intensifies the challenge for earthquake response and recovery, and in these areas large earthquakes can be catastrophic. The impact is magnified by vulnerability factors including non-enforcement of building codes, knowledge gaps, urban poverty and poor governance and capacity (IFRC, 2012). ISDR (2009) concluded that earthquake vulnerability is "highest in countries with relatively higher levels of economic and urban growth, but that have not yet put in place planning and regulatory frameworks capable of factoring disaster risk reduction considerations into urban development".

Earthquakes are geophysical disasters that occur suddenly and affected people may not be prepared with disaster mitigation measures. They can cause a number of secondary hazards such as landslides, avalanches and tsunamis and also can cause damage to buildings and infrastructure. The aftershocks and secondary hazards can be more damaging than the earthquakes themselves. People can die due to the collapse of buildings, landslides, rock falls or a tsunami. Structural collapse of buildings is more frequent in countries where there are high rates of urbanisation and weak enforcement of building codes resulting in poor quality and informal housing construction.

Earthquakes present unique challenges for Disaster Risk Management, as they are rapid-onset, occur often with little warning, although a repeat event may not occur for many decades. Preparedness and mitigation measures are less likely to be implemented than for more recurrent events. Earthquakes in urban areas can challenge humanitarian agencies given that:

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- The high population densities and limited space available for recovery and reconstruction works.
- The effect is greatest on buildings, infrastructure, livelihoods, and food and water supply.
- The effect is greatest in urban areas where considerable rebuilding or repair of buildings and infrastructure is needed.
- There are often significant proportions of informal settlements with limited access to infrastructure and facilities even prior to an earthquake.
- Earthquakes in urban settings may trigger secondary hazards such as fires due to damage of gas lines or electric supply infrastructure (IFRC 2012; Mitchell, 2011).

As Reale and Handmer (2011) note, the poorest sector of society is the most impacted by disasters. The poor and marginalized are particularly vulnerable and have reduced capacity to defend themselves against the rights of others. Earthquakes may also cause tenure insecurity, or exacerbate insecure land tenure that already exists, exposing hidden vulnerabilities.

Several authors have argued that insecure tenure is a factor in the vulnerability of communities and households, and affects their ability to respond to natural disasters (e.g. Reale and Handmer 2011; Usamah et al., 2014). People are vulnerable to an earthquake when they are exposed, isolated, insecure and defenceless in the event of an earthquake. Vulnerability occurs when landholders lose access to land resulting in limited livelihood options, or impacting their social or financial capital. In the context of earthquakes, the effect is greatest on buildings and infrastructure in urban areas where there are often a significant proportion of informal tenures. For those exposed to earthquakes or the associated effects of landslides and other hazards, vulnerability factors include settling in areas prone to earthquakes or landslides, using housing materials unable to withstand an earthquake, and insecure tenure leading to a tangible fear of eviction (Reale and Handmer 2011).

Where land tenure is insecure, disasters can be a catalyst for loss of land or eviction. Where alternative livelihood and housing options are limited this loss of land can increase vulnerability (Reale and Handmer, 2011). Where insecure tenure results in the loss of land, other impacts can include homelessness, inadequate housing, loss of identity, or displacement from community (Reale and Handmer 2011). Long-term displacement or resettlement, possibly far-removed from the pre-disaster land creates an added risk of loss of livelihood further increasing vulnerability (Mitchell, 2010). Displaced populations who leave their habitual residence due to an earthquake, threat or conflict are vulnerable. Insecure tenure may also increase vulnerability where there is no loss of land, as it acts as a deterrent to investment in land (including DRR).

Effective land administration can help address one of the causes of vulnerability – insecure land tenure − through reducing the incidence of loss of land and helping facilitate restitution of people to their land who are displaced by an earthquake. By resolving existing land disputes beforehand, the likelihood of an earthquake effecting tenure security is diminished. Where land tenure is secure and protected against threats by others, people and groups are less likely to be subject to arbitrary eviction. Land administration can also reduce exposure to earthquakes through zoning areas of high hazard risk, improved enforcement of zoning and building regulations, and recording all legitimate land rights.

In response to the unique challenges faced by each country, and the complexity of land administration during a response to an earthquake, we have developed a framework for evaluating the earthquake-responsiveness of a land administration system. While many papers have been published on the experiences of land agencies after disasters (e.g. Jha et al., 2010; Caron et al., 2014; Zevenbergen et al., 2015), as far as we are aware, this is the first attempt to distil the lessons from earthquake response and recovery that might have relevance to many countries.

This framework is based on an analysis of the impact of an earthquake in Haiti, Nepal and New Zealand – and we draw out general principles that broadly apply to most country contexts. These countries provide a contrast of experiences, and have different levels of development and capacity. The discussion is arranged under a Disaster Risk Management Framework (Baas et al., 2008) where the term “disaster risk management” is used to refer to a management approach that combines the pre-disaster functions of prevention, mitigation and preparedness with emergency response, recovery and reconstruction in a cycle. We also discuss the stages of response and recovery as including emergency relief, early recovery, and long-term recovery. The lessons from our case studies then informs preparedness (developing the capacity of land agencies to effectively anticipate, respond to and recover from the impacts of earthquakes) and mitigation (limiting the adverse impacts of earthquakes) measures in land administration. Vulnerability in this paper refers to the characteristics and circumstances of households or the land administration system that cause susceptibility to the damaging effects of an earthquake and may react adversely (Usamah et al., 2014). The degree of that adverse reaction is partly conditioned by the land administration system as outlined later in the paper.

Table 1 provides some economic and governance indicators illustrating the differences in capacity these countries faced in managing the challenges resulting from major disasters. It is evident that New Zealand was in a stronger position to respond to the disaster than Nepal, and Nepal was in a stronger position to respond than Haiti. And yet the land administration system in New Zealand was put under considerable and unusual pressure (Grant et al., 2016). It is therefore reasonable to say that most countries will struggle to cope for many years following a major earthquake.

This research is based on a literature review. Two of the authors were involved in a regulatory role with the land agencies in Nepal and

Table 1
Indicators of capacity to respond to economic and land administration issues resulting from major earthquakes (Source: Grant and Mitchell, 2016).

Response capacity indicators	Haiti	Nepal	New Zealand
Main seismic event(s)	January 2010	April 2015	September 2010 & February 2011
Estimated economic damage	US$7.8B	US$7B	US$30B
GDP	US$6.6 B (2010)	US$19.8 B (2014)	US$145 B (2010)
Damage as proportion of GDP	118per cent of GDP	35per cent of GDP	20.6per cent of GDP
GDP per capita	US$650	US$2374	US$29,390
World Bank Doing Business – Registering Property 2015[a]	179th of 189 countries	72nd of 189 countries	1 st of 189 countries
World Bank Doing Business – Construction Permits 2015[b]	167th of 189 countries	78th of 189 countries	2nd of 189 countries
World Bank Property rights & rule based governance index (1-low, 6 = high) 2015Error! Bookmark not defined.	2.0	3.0	Not available – estimated to be 6
Transparency International Corruption Perception Index 2014[c]	161 st of 175 countries	126th of 175 countries	2nd of 175 countries

[a] World Bank Open Data (*data.worldbank.org/data.worldbank.org/*).
[b] World Bank Doing Business (*www.doingbusiness.org/www.doingbusiness.org/*).
[c] Transparency International (*www.transparency.org/cpi2014/resultswww.transparency.org/cpi2014/results*).