Assessing Social Vulnerability to Fire Hazards at the Kumasi Central Market, Ghana

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ABSTRACT

This article describes how social vulnerability indicators can assist with informing fire disaster relief preparations. Fire outbreaks at the Kumasi Central Market in Ghana have become an annual event. About 27 fire disasters were recorded between 2007 and 2016. This article uses a spatially-centered approach to assess human vulnerability to fire risk at the location. The study used a geographic information system to compliment indicators of vulnerability to assess the level of fire risk and adaptive capacities. Mixed method approach was also used to collect survey data from traders and emergency response agencies. Data sets were analyzed using SPSS and ArcGIS. The study revealed that: most of the damaging fires occur during the dry season; fire hydrants in the market are insufficient and inaccessible; and there are low levels of awareness on fire risk and weak adaptive capacities. The article recommends provision of more fire hydrants and mass education on disaster risk prevention. Also, the market must be reconstructed with fire resistant materials and designed to make it more accessible to fire emergency response.

KEYWORDS

Adaptive Capacity, ANOVA, Chi-Square, Disaster Management, Education, Exposure, Geographic Information System, Multiple Regressions, Network Analysis, Risk

INTRODUCTION

Human societies have battled with fire and its destructive consequences for generations, including the Great Chicago fire of 1871, Tokyo fire of 1923, and Texas City fire of 1947 (Danielek, 2011). For example, the San Francisco fire of 1906 resulted in the destruction of 25,000 buildings and about 3000 deaths whilst that of Boston resulted in thousands becoming unemployed, hundreds of businesses ravaged, and many insurance companies going bankrupt (Danielek, 2011). The anthropogenic sources of fire are varied and may include poor and faulty electrical wiring, overloading power points, use of faulty appliances and equipment, improper use of lighters and candles, etc. (National Fire Protection Association, 2016; Addai, Tulashie, Annan & Yeboah, 2016). For example, it has been estimated that the use of inappropriate cables causes about 25% of fire outbreaks in Kumasi (Amoako, 2014). In the first quarter of 2016, Ghana recorded 2,469 fire outbreaks out of which 21% occurred in the Ashanti Region (Ghana National Fire Service, 2016). The 2016 figure compared to 2,036 fire outbreaks within the same period in 2015 represents 21.27% increase. One of the most fire prone areas in Ghana is the Kumasi Central Market (KCM), a commercial center with over 11,003 retail stores.

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The increasing impact of fire on traders brings into question their ability to resist, absorb and recover from the effects of fire in a timely and efficient manner, preserve or restore basic structures that supports their livelihoods. Several studies have concluded that a lack of response capacity, determined by limitations in terms of access to and mobilization of resources in responding to an identified hazard, including pre-event risk reduction, in-time coping, and post-event response measures hampers the disaster management process (Birkmann et al., 2013; United Nations International Strategy for Disaster Reduction, 2009; International Institute for Sustainable Development, 2007).

One would expect that people who have long experience with fire would develop better coping and adaptation strategies in coordination with government institutions. Therefore, if fire victims continue to suffer heavy losses, then explanations should be pursued. The study sought to analyze the nature and level of fire risk, the characteristics of exposures and adaptive capacities. The KCM was selected because it has a record of annual fire outbreaks which causes great loss to the traders, KMA and Ghana as a whole.

CONCEPTUALIZING THE NEXUS OF SOCIAL VULNERABILITY AND FIRE HAZARDS

Scholars from different knowledge domains and diverse communities of practice conceptualize vulnerability in very different ways. According to Kasperson & Kaperson (2005), the choice of definition of vulnerability may depend on its suitability for a particular hazard and its interpretation for policy or action. Vulnerability is “the conditions that make an individual or a system susceptible to experience harm as a consequence of an external shock” (Müller et al., 2011). It is also the propensity of exposed elements such as human beings, their livelihoods and assets to suffer adverse effects when impacted by events (Cardona et al., 2012). To understand how vulnerability is generated in the Kumasi Metropolis, the models of Turner et al., (2003) and Birkmann et al., (2013) were adapted and applied (Figure 1).

Social vulnerability could be expressed as the degree to which a trader is likely to experience harm due to exposure to fire hazard. Risk is the probability and magnitude of consequences after a hazard (Turner et al., 2003; Birkmann et al., 2013). According to Turner et al., hazards are defined as threats to a system, comprised of perturbations and stress (and stressors), and the consequences they produce (Turner et al., 2003). A perturbation is a major spike in pressure beyond the normal range of variability in which the unit of analysis operates. Perturbations commonly originate beyond

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**Figure 1. Risk-Hazard Model of Vulnerability to Fire Hazards (Source: Adapted from Turner et al. (2003); Birkmann et al. (2013))**
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