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Assessing social vulnerability in disaster mitigation. Case study: Bucharest Historic Center/ Bucharest / Romania

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Social vulnerability is as much a part of risk as building damage, hazard magnitude and economic loss.

Various natural hazard assessment studies measure the vulnerability of people and communities using different indicators (HAZUS 99; The Earthquake Disaster Risk Index EDRI, developed by Rachel Davidson in 1997; Ferrier, 2000; The Cities Project, developed by Granger *et al.*, 1999, 2001, Dwyer A. et al., 2004).

This study focuses on only one aspect of social vulnerability, which relates to personal attributes (an individual and their household). This level of social vulnerability is defined as *the ability of an individual within a household to recover from a natural hazard impact* (Dwyer A. et al., 2004).

Bucharest, because it's population, building stock, administrative and economic role, in combination with the seismic hazard induced by Vrancea source, can be ranked in Europe as one of the cities with highest seismic risk, and the 10^{th} capital city worldwide (Bonjer *et al.*, 2003, Arion *et al.*, 2004). Next large earthquake, with macroseismic intensity in the epicentrale zone: I_{Buc} = VII or VIII (MSK-64 scale), is predicted to strike in the window of probability 2006-2008, with a predictability value of 67% (Enescu and Enescu, 1996).

In the city (χ^2 (10) = 23,2, p $>$0.01), there are 23,000 vulnerable dwelling buildings that will be severely damaged by an earthquake (from 108,834 number of buildings, part of 32 residential areas belonging to 6 sectors). Most of the buildings in the I^{st} and II^{nd} seismic risk category**[1] The classification of existing building stock with respect to period of construction, structure type, class of seismic risk (I-IV), claimed by the

Minister of Public Works - Order No.6173/NN/1997. (categories of most great seismic vulnerability), having more than 4 floors in addition to the ground floor, lie in the historical center of the capital, having been built between 1875 and 1940. The 19^{th} century buildings are built over basements dating from the 18^{th} century. The communist system had a continuous policy designed specifically to lead to the decay and degradation of the historic center. For instance, there was no programme to reconstruct and improve the infrastructure following World War Two. As a consequence, the former owners left the buildings, which have decayed ever since, many of them being in ruin today. These buildings are now occupied by a population of modest means, many of them illegally living there.

This study is investigating aspects of social vulnerability, quantifying people's understanding of earthquake hazards, their knowledge regarding earthquake hazard, their preparedness to deal with this events, concordant with the multiple restructuring process the Romanian society went through.

The surveys of over 200 residents perceptions of earthquake hazards were carried out, in parallel with an evaluation of housing conditions and dwellings vulnerability.

The indicators chosen for this study have been selected from extensive literature reviews, discussions with researchers and previous experience in risk perception surveys. Most indicators are socio-economic, while "Resilience Capacity" is a social vulnerability indicator, and "Losses" is a hazard indicator relating to the impact of an earthquake. Other variables that provide an insight into an individual's characteristics included less tangible factors, as motivational, emotional or psychological aspects.

While not exhaustive of factors that contribute to a person's relation towards a natural hazard, this set of variables provided an indication of how people perceive earthquake risk in the historic center of Bucharest and how they relate with the event of a natural hazard impact. An aspect was to test how people try to manage earthquake risk, if they see themselves as vulnerable to that risk.

Slovic noted that if people perceive a risk to be real, then they would behave accordingly (Slovic, 2000), and Schumm mentioned that the way individuals perceive their vulnerability to natural hazards shapes their reaction and ways of coping with these hazards (Schumm, 1994). These assumptions were also discussed in regard to the socio-economical status of the people interviewed.

The indicators were generally considered to be independent, but not equally important variables, and the effects of a combination of particular indicator values compared with other combinations were explored.

We used Pearson chi-square test to examine the connection between variables and to

test the validity of the working hypothesis, at a significance level of $p < 0.05$. The partial correlation coefficient and the multinomial logistic regression were used to verify the connection between more variables.

A non-parametric binomial *z test* was applied to see the significance of differences in the earthquake risk perception level between 1997 and 2005, and the influence of the ever-increasing pressure of economic problems on daily life during the last several years.

All statistical processing used the SPSS 13 programme.

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