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VULNERABILITY ASSESSMENT FOR THE NEAR-EARTH OBJECT IMPACT SCENARIO

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ABSTRACT

The task of this paper is to present two vulnerability assessment methodologies: CIMDEN 2001 structural vulnerability assessment and PAR (Pressure and Release) model which can be used for the hazards produced by Near-Earth Object Impact scenarios.

Vulnerability can be described as “the incapacity of a community to absorb, via auto-adjustments, the impacts of a change in the environment”. In other words, its incapacity to adapt to such a change. Vulnerability assessment addressing the social, economic, environmental and institutional aspects occupies the central part within the research and human capacity building. There are several types of dimensions of vulnerability: physical, environmental, economic, social, political, technical, ideological, ecological, institutional, educational, health-related, cultural, etc. [1]

The Near-Earth Object Impact Scenarios (listed below) influences all the various dimensions of vulnerability mentioned above.

Near-Earth Object Impact Scenarios
- atmospheric entry
- airburst (an explosion near the atmosphere)
- surface impact

They produce the following hazards which affects the well-being of humans:
- shock wave (overpressure shock) and an blast of wind
- thermal radiation
- tsunamis
- flying debris (ejecta deposition)
- seismic shaking
- cratering

Household Sector Approach: CIMDEN 2001

In a different approach, the author has developed a procedure to assess four different types of vulnerabilities associated with the housing sector at the local level: physical or structural, functional, social, and economic income. In this method, each type of vulnerability is measured through parameters which are directly related to the type of vulnerability in question, classifying the different types of options commonly available in communities for these variables in three ranges: low, medium and high.

Example of adapted Flood Structure Vulnerability Assessment. Important: building materials depend on the region of interest.

		LOW	MEDIUM	HIGH
	WEIGHT	1	3	5
Walls	15	bricks (mortar as a binding material), blocks (made of brick and concrete), stone	siporex, durisol, bricks with mud as a binding material	adobe-mud, wood
Foundations	10	concrete (regular and reinforced), stone	bricks (mortar as a binding material)	the mixture of bottom ash, water and cement
Height of the first floor	5	more than 100 cm from the street level	from 50 to 100 cm from the street level	to 50 cm and below street level
Number of floors	5	first floor without a basement	first floor with a basement, two floors without a basement	two floors with a basement, three floors with and without a basement
Doors	1	without glass	with small glass area	with large glass area
Windows	1	small windows (small glass area)	medium sized windows	large windows (large glass area)

$V_{estruct} = 15 \times 3 + 10 \times 5 + 5 \times 5 + 5 \times 1 + 1 \times 3 + 1 \times 1$

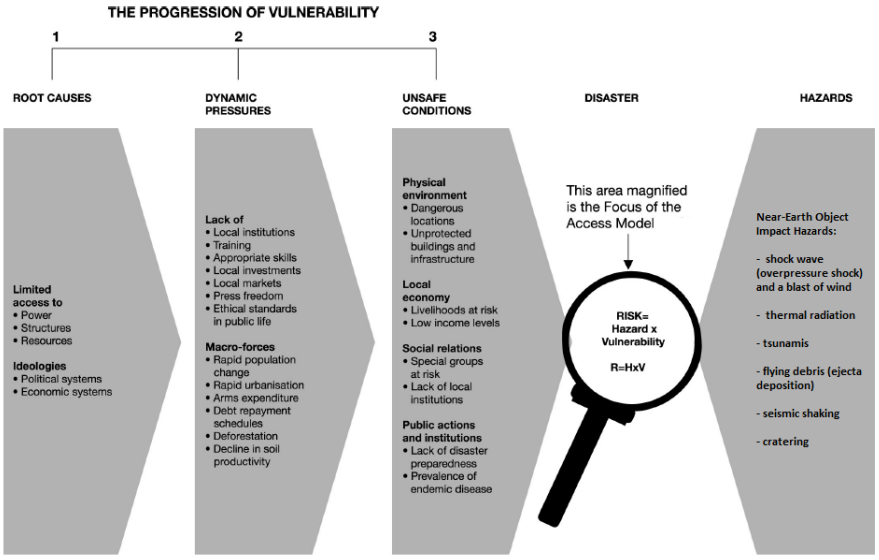
= 129 medium degree of structural vulnerability

Degree of structural vulnerability	Numerical range
Low	37-80 points
Medium	81-130 points
High	131-185 points

Structural vulnerability of individual houses with an assigned color (degree of structural vulnerability) overlapped with simulated flooded area based on DEM and historical disaster database.

The Disaster Pressure And Release Model

The Pressure and Release Model - PAR model defines vulnerability as the characteristic of a person or group of persons in terms of their capacity to anticipate, cope with, resist, and recover from the impact of a natural hazard. In addition, they propose the progression of vulnerability associated with root causes, dynamic pressures, and unsafe conditions.



Pressure and Release (PAR) model: the progression of vulnerability with Near-Earth Object Impact hazards. [3]

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