Discussing Vulnerability, Capacity And Resilience of The Community In The Face of Earthquakes At A Microscale

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SUMMARY:
Concepts and indexes for vulnerability, resilience and coping/adaptive capacity, mostly aiming at measuring and enabling comparison on national, urban or community scales mostly using general large-scale data, have been widely addressed in the hazards literature. Experience from disasters indicates the need for preparedness also at the individual level. Efforts to withstand a disaster and its consequences at the local level depend on risk mitigation activities and preparedness together with individual and institutional capacities. Thus in a research project, a questionnaire was conducted to 600 household representatives through interviews and institutional questionnaires were sent to primary institutions of the selected district in Istanbul. Assessing the physical living conditions, socio-economic situation, vulnerability factors, capacities, risk awareness, risk mitigation of the households, and physical mitigation measures together with administrative measures of the institutions, it is aimed to propose an approach to assess the possibility of a community to withstand the impact of a big earthquake.

Keywords: social vulnerability, resilience, coping capacity, risk mitigation, community preparedness

1. BACKGROUND

Vulnerability, risk, resilience and coping capacity terms have been used in a variety of manners in literature. Birkmann (2006 p.11-12) states that since 1980s, the alternative approach of using vulnerability as the starting point of risk reduction combines the susceptibility of people and communities exposed with their social, economic and cultural abilities to cope with the probable damage. In their Pressure and Release Model that has first been introduced in 1994, Wisner et al (2004) suggest to interpret risk as a function of hazards and vulnerability that is caused by various conditions authors present. In this model, lack of conditions that build resiliency is also taken into consideration besides conditions that increase vulnerability. Similar approach is present in the model initiated by Cardona, then revisited together by Barbat and Carreño (Carreño, et al., 2007). The authors underline the need of a multidisciplinary evaluation of the term risk, and suggest to cover socio-economic fragility and lack of resilience as aggravating factors besides physical risk, Conditions caused by social fragility and lack of resilience according to authors are indicated to constitute the second order impacts of the disasters. In 1997 structure developed by Davidson and then adopted by Bollin et al. in 2003 (from Birkmann, 2006), risk is defined as the sum of hazard, exposure, vulnerability, and capacity & measures. The latter encompass physical planning, social capacity, economic capacity and management. Billing and Madengruber (2006) mention that coping capacity is a key concept in vulnerability assessments. They relate vulnerability and coping capacity as two sides of the same coin. They developed a model to compare coping capacity of the countries. The index they propose, consist of four main indicators; the level of institutional preparedness, level of mitigation measures taken, number of IFRC volunteers, and modified UNDP Disaster Risk Index as a composite indicator, for each country. The authors also underline the distinction between individual and institutional coping capacities. Cutter et al. (2008) adopt the term resilience as "the ability of a social system to respond and recover from disasters together with inherent conditions that allow the system

to absorb impacts and cope with an event, as well as post-event, adaptive processes that facilitate the ability of the social system to re-organize, change, and learn in response to a threat". In the model they propose to assess the resilience of place, antecedent conditions include both inherent vulnerability and inherent resilience as products of place-specific social, natural, and built environment systems. Authors state that antecedent conditions interact with the hazard event characteristics to produce immediate effects. Then the immediate effects are attenuated or amplified by the presence or absence of mitigating actions and coping responses in the community, which themselves are a function of antecedent conditions. Therefore the total hazard or disaster impact is presented as a cumulative effect of the antecedent conditions, event characteristics, and coping responses. Within the boundaries of this conceptual model, Cutter et al. (2008) suggest several indicators to measure inherent resilience as the first step.

UN ISDR (2009) defines resilience as the ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions. Same organization defines coping capacity as the ability of people, organizations and systems, using available skills and resources, to face and manage adverse conditions, emergencies or disasters. Considering the above definitions, it can be deduced that the term resilience is usually used as encompassing coping capacity for it also cover the phase recovery.

The comprehensive studies and indexes – some mentioned above - mostly aim at measuring the discussed concepts and enable comparison at national, urban or community scales mostly using general large-scale data. Experience from disasters indicate the need for the individuals to get prepared as during the first 72 hours after a disaster most help comes from those people immediately around (BU KRDAE, 2006). Karanci (2007) underlines the importance of building awareness among the community and providing their participation in order to achieve an effective disaster risk management. Wisner (2006) emphasizes the importance of self-assessment of capacities of the communities that enable participatory engagement in their own risk management which supports community-based disaster management approach.

Withstanding a disaster and its consequences depend on risk mitigation activities and preparedness together with individual (or household basis) and institutional capacities. In this study, we aimed to define the possibility of a community in a certain locality to withstand the impact of a big earthquake as the resultant assessment of individual and institutional vulnerability and resilience factors.

2. CONCEPT AND METHODOLOGY

The logic of the assessment as discussed before (Sungay et al., 2010) consists of two main elements. The first one is that individuals and institutions should act together in preparing and coping with disasters. In addition, while proceeding on the project, the project team observed the importance of including businesses both big entities and small and medium size enterprises which are significant in business continuity and direct and indirect effects on economic loss. In a further effort this approach is planned to be integrated. The second element is that the assessment should take into consideration physical conditions, socio-economic situation, several demographic factors, and risk mitigation and preparedness actions.

The relevant data was collected through a household survey on individual level, and with questionnaires directed to relevant institutions on institutional level within the boundaries of a pilot district in Istanbul consisting of 33 neighborhoods. Household questionnaire consisting of 78 questions was developed through literature review and consultancy received from experts. The final design of the questionnaire was developed and conducted to 600 household representatives through interviews by the research company. The samples are determined by clustered sampling method with number of clusters proportional to size of the neighborhood populations. The questionnaires for institutions consist of relevant and appropriate questions for each institution. The data was collected by

receiving written responses from the institutions. The questions as mentioned above cover physical measures, social and psychological measures and administrative measures. The study on the two surveys helped identify most relevant and necessary factors in achieving the overall aim of the study and defining the indicators.

2.1. Individual / household indicators

Possible maximum positive response and rapid recovery are essential to achieve a relatively better condition after an earthquake. For individuals and families, the logic in assessing capacity for achieving such condition had been to review; physical living environment's safety and facilities; individual preparedness together with mitigation measures and capacity for self-sufficiency; possibility to receive help; capacity to help others; social and economic background together with rights owned and resources for recovery.

The indicators chosen to represent the above-mentioned assessment logic are presented in Table 1. It can be observed that some indicators just affect vulnerability or just resilience while some indicators affect in both ways.

The context of most of the vulnerability factors have been studied and published in several articles (such as Cutter, 2003; among others), therefore they are not defined once again in this study. The assessment of each indicator is defined to be made as follows:

- "Building Safety" indicator: The three basic features of the building are used as the basic vulnerability assessment attribute; age of the building; number of stories; and construction type. Almost all urban-scale earthquake risk assessment studies in Turkey used these features to characterize and quantify the seismic vulnerability of buildings.
- "NSM Application / Risk Reduction" indicator questions the rate of non-structural mitigation measures taken in the household, that is to say furniture and other appliances that can topple and slide to be secured.
- "Education" indicator questions both illiteracy and graduated school.
- "Age Dependency" indicator questions ratio of elderly over 65 years old together with children under 14 years old to the household population. The age grades are compatible with Turkish Statistical Institute's definitions as the institution recognizes youth dependency as 14 (TSI, 2011).
- "Disability" indicator questions ratio of people with physical disabilities and with mental disability to the household population.
- "Single Parenthood" indicator questions the widowed and divorced parents taking care of their children alone in a household.
- "Income" indicator questions both the total monthly average income of a household to be compared with the national poverty limit declared by the Turkish Confederation of Labor Unions; and the sufficiency of the income to the requirements of that family.
- "Need for Special Health Treatment" indicator questions ratio of people in need of technical treatment such as dialysis together with those on permanent medication, to the household population.
- "Unemployment" indicator questions the ratio of unemployed people to the household population excluding students, housewives and retired.
- "Savings indicator questions whether the family is able to make savings or has some that may help ease recovery process.
- "Debt" indicator questions whether the family has any debt, as contrary to savings, it may hinder the process of recovery.
- "Insurance coverage" indicator assesses three items: whether the family purchased earthquake insurance for their house; whether members are covered with any kind of health insurance; and if they have a vehicle, whether that also is covered with an insurance.

Table 1. Individual / Household Indicators

		INDICATOR
POSSIBILITY TO SUSTAIN HARM & INJURY	Physicl En.	Building Safety
		NSM Application /Risk Reduction
	Demographic & Economic Background	Education
		Age Dependency
		Disability
		Single Parenthood
		Income
		Need for Special Health Treatment
		Unemployment
RESOURCES & SKILLS	Capacity and Resources for Self-Sufficiency	Savings
		Debt
		Insurance Coverage
		Mobility
		Immediate Vicinity Potential
		Ease in Meeting Family
		Trainings on Preparedness
		Physical Preparedness Level
		Potentials
		Psychology
	Help /ing	Ability to Take On a Task
		Solidarity

- "Mobility" indicator evaluates whether the family owns any kind of vehicle together with whether they own another apartment in that city or another one; and whether the family has relatives they can move beside temporarily in case of a big earthquake damage.
- "Immediate vicinity potential" indicator questions both the areas that may pose risk during an earthquake such as a high-voltage transmission line, and areas and enterprises that may help in meeting supplies such as a well or a supermarket. It also questions the accessibility to health care services in terms of proximity within walking distance.
- "Ease in meeting family members" is believed to be one of the most important factors after a disaster. It questions; children's school proximity to home; both parents' workplace proximity to home; and to their children's schools.
- "Trainings on Preparedness" indicator is evaluated different from physical preparedness level as trainings received not necessarily reflect as risk reduction or preparedness actions however, they do raise awareness. Here, any kind of training related to disasters such as basic awareness, community volunteer, non-structural mitigation and first aid, is questioned.
- "Physical preparedness level" is another strong indicator as it reflects the absolute actions taken to be prepared. The indicator provides a similar evaluation of The Public Readiness

Index (The Council for Excellence, 2006). In this indicator, actions such as having a family plan, keeping flashlight and shoes beside bed, keeping supplies, having a fire alarm / smoke detectors, fire extinguisher, practicing evacuation are assessed.

- "Potentials" indicator assesses items such as having a family member knowing how to use radio transmitter; members having a cell phone; presence of internet in the household which help to assess the possibility to communicate after and reach information before .
- "Psychology" indicator questions whether the household representative feels prepared; whether he/she is able to stay calm or would panic in such a case; and evaluates some questions on believes such as "there is nothing we can do" or "precautions I take would work".
- "Ability to take on a task" questions: special skills of family members such as carpentry; it also questions whether the representative would be willing to take on any task such as logistics, search & rescue, first aid after such a disaster – which also depend on the trainings received - ; and whether a member of the family is a member of a related NGO.
- "Solidarity" is again one of the significant indicators to be able to receive help in times of need. It is assessed by questions on whether the family is in relation with their neighbors so that they can support each other in daily life and ask for help; whether they have friends and/or relatives living in the same neighborhood. It also questions whether family members play role in or attend neighborhood organizations

Although several of the above-mentioned indicators can be grouped under a general indicator, this was avoided due to the importance of each and their effect on capacity.

2.2. Institutional indicators

In addition to individual preparedness, the preparedness of local key institutions is essential to increase the capacity to reduce risks, respond and recover. In this study, the primary institutions are accepted as; district governorship disaster management center, district municipality, general directorate of education, general directorate of health, district police, fire brigade, district branch of Turkish Red Crescent, and neighborhood headmen.

The indicators chosen to represent the institutional assessment logic are presented in Table 2. Their context may differ slightly according to the institution. In general, the indicators question the following:

- Building safety assesses whether the building is investigated by competent engineers and its results.
- Non-Structural Mitigation (NSM) Applications is essential for risk reduction in order to protect lives, assets, records and to provide business continuity. This indicator assesses the ratio of the application if any.
- Tracking staff preparedness is significant in order to be able to function effectively after a disaster. It questions whether the institution keeps track of its staff preparedness and building safety.
- Physical preparedness for an institution in addition to above-mentioned indicator of NSM applications is accepted as; keeping necessary supplies and medical materials together with lodging to be available for key staff and their families in case of a disaster.
  Having an emergency plan is one of the most vital preparedness actions as it plans for risk reduction as well as planning for coordination of response. The indicator questions such plan's existence together with its aspects that are taken into consideration, its frequency of update. It also questions whether new staff is informed on the plan.
- Exercising the emergency plan and performing drills is a complementary part of the emergency planning as it provides the staff to understand practice and develop the plan. This indicator assesses whether the plan is being practiced through exercises and drills.

Table 1. Institutional Indicators

	INDICATOR
POSSIBILITY TO SUSTAIN HARM	Building Safety
	NSM Applications / Risk Reduction
	Tracking Staff Preparedness
RESOURCES & CAPACITIES	Physical Preparedness
	Emergency Planning (EP)
	EP Drills & Exercise
	Staff Training
	Emergency Fund
	Data Archive
	Psychological Support to Staff
	Adequecy of Teams & Equipment
	Cooperation & Coordination
	Contribution to the Preparedness of Community

- The second complementary step of the emergency planning is staff training. It is significant to acquire a well-equipped staff to identify and reduce risks as well as to respond effectively. This indicator questions three items; constant vocational retraining; training on related subjects of disaster awareness, risk reduction and response; briefing of the emergency plan to the personnel who take responsibility on the response teams.
- Having an emergency fund to allocate in an emergency would accelerate response and recovery efforts. This indicator questions the existence of such fund.
- Data archive is very important for an institution to function effectively even at normal times. Therefore having the backup in another safe location would play important role in risk reduction. This indicator assesses the adequacy of the coverage of that archive (which changes according to the institution) together with its backup.
- Most of the institutions that operate especially for emergencies such as police, fire brigade and disaster management center staff normally work under pressure and may need support at certain intervals. This questions both this condition and whether the staff is able to receive support during times of crisis.

- The context of adequacy of teams & equipment indicator differs according to the institutions. Generally the indicator attempts to ask the institution whether they find their human and equipment resources sufficient to respond to an intense earthquake disaster.
- Cooperation & coordination between institutions is required to achieve effective disaster management locally. Therefore this indicator questions whether the institution carries out meetings and drills together with other institutions.
- Contribution to the preparedness of the community indicator questions whether the institution provides the community with trainings on disasters and response together with their contribution to the risk reduction activities locally.

3. DISCUSSION

In case of the adopting the assumption that coping capacity is the complementary side of vulnerability, then the assessment of discussed indicators together with individual and institutional levels may be defined as the evaluation of resilience of the community. Considering the DROP model by Cutter et al. (2008), the indicators both represent the antecedent conditions formed by inherent vulnerability and resilience, and provide a projection to the coping responses.

As stated before, the project team believes the importance of assessing also the local businesses in order to reach a more complete evaluation of a community. The assessment methodology has not been finalized yet. The project team avoids assigning weights to the indicators – especially for the household assessments. It is quite likely to assign scores to be "1" at maximum and "-1" at minimum. The institutional indicators each affect both in positive and negative means. However, the individual / household indicators may just affect vulnerability or just resilience while some indicators affect in both ways. This hinders an even scoring.

The assessment method proposed here is actually a form of self-assessment in principle. As Wisner (2006) introduces, self-assessment takes a problem solving perspective and is proactive as it gives thought to both vulnerability and capacities. The self-assessment is the basis of community-based disaster management (Wisner, 2006) therefore; the proposed assessment methods would strengthen the bottom-up approach of the disaster management discipline.

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