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Integrated Natural Disaster Risk Assessment:
The Socio-Economic Dimension of Earthquake
Risk in the Urban Area

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Abstract

Understanding and formulation of risk of a natural disaster requires consideration of every aspect of risk, which can be handled by development of integrated approaches. In such integrated approaches, several discipline's views are incorporated into risk assessment to see the whole picture. Hence, the risk which can be experienced before and / or after a natural disaster should be a common concern for both natural and social disciplines and should be handled through a interdisciplinary approach. A field research was conducted with 1500 households, selected through stratified random sampling, using the database obtained from the Eskisehir Greater Metropolitan Municipality. Interviews were made face to face with one adult person over the age of 18 in each household. The effects are analysed in three levels : before, during and after a possible earthquake. The major dimensions of socio- economic vulnerability is determined as demographic, socio-economic, social Security and insurance and behavioural. Data collected is analysed with factor analysis and a socio-economic and cultural vulnerability index is calculated. Level of income, education, age came out as the major indicators determining the level of awareness of risk and being prepared for a possible earthquake. Also relative poverty, presented a risk before and after the earthquake. Thus, during the earthquake, social networks of the individuals, though seemed to be disintegrated to some extent, was found to be the most significant indicator, providing the people with a variety of support facilities. Social network mechanisms decreased the effect of disaster and

supported the coping strategies of individuals. However, reliance on social networks also presented a risk and vulnerability for the households if there are no other coping strategies.

Integrated Natural Disaster Risk Assessment: The Socio-Economic Dimension of Earthquake Risk in the Urban Area

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Abstract :

Understanding and formulation of risk of a natural disaster requires consideration of every aspect of risk, which can be handled by development of integrated approaches. In such integrated approaches, several discipline's views are incorporated into risk assessment to see the whole picture. Hence, the risk which can be experienced before and / or after a natural disaster should be a common concern for both natural and social disciplines and should be handled through a interdisciplinary approach. A field research was conducted with 1500 households, selected through stratified random sampling, using the database obtained from the Eskisehir Greater Metropolitan Municipality. Interviews were made face to face with one adult person over the age of 18 in each household. The effects are analysed in three levels : before, during and after a possible earthquake. The major dimensions of socio- economic vulnerability is determined as demographic, socio-economic, social Security and insurance and behavioural.

Data collected is analysed with factor analysis and a socio-economic and cultural vulnerability index is calculated. Level of income, education, age came out as the major indicators determining the level of awareness of risk and being prepared for a possible earthquake. Also relative poverty, presented a risk before and after the earthquake. Thus, during the earthquake, social networks of the individuals, though seemed to be disintegrated to some extent, was found to be the most significant indicator, providing the people with a variety of support facilities. Social network mechanisms decreased the effect of disaster and supported the coping strategies of individuals. However, reliance on social networks also presented a risk and vulnerability for the households if there are no other coping strategies.

Introduction

Understanding and formulation of risk of a natural disaster requires consideration of a wide range of risk aspects, which can be handled by developing an integrated approach. In such an integrated approach, an interdisciplinary view should be incorporated into a risk assessment, only then we will be able to get a more complete and holistic picture of the actual situation. The risks experienced before, during and after a natural disaster should be a common concern for both natural and social disciplines. It seems to be of crucial importance to emphasize the interconnection of social characteristics and natural disasters. From a sociological perspective the risk of falling victim to natural disasters is higher among certain sections of the population. Thus, it seems to be of great interest to determine those vulnerable groups.

Risks might be extremely difficult to be forecasted, however their effects and consequences are principally more easily estimated and measured. In this point vulnerability is the key concept for

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this probability estimation. Vulnerability is generally taken to be the ability to anticipate, resist, cope with and respond to a hazard (Blaikie et al, 1994). Vulnerability can also apply to a particular group or social unit and to the structures and institutions – economic, political and social – which govern human lives. Instead of focusing solely on the risk of exposure to physical phenomena, this approach recognises that such physical phenomena are embedded in and mediated by the particular human context (social, political, economic, and institutional) in which they occur. Risk on the other hand is the lack of capacity to cope with the negative impacts that various hazards, in specific earthquakes, might bring to individuals or human systems.

Vulnerability to natural disasters are important, but still even more important is if it touches the majority of a given population and not only a small number of certain groups, like poor, disadvantaged, dependent groups, who might be more seriously falling at risk. Here it seems to be however of importance to address attention also at access to help and recovery after the event, and also to look at differences among more and less vulnerable groups in terms of coping strategies during the actual event of the disaster. This broader approach has thus highlighted the importance of assessing the complex reality of vulnerability when predicting future impacts of earthquakes as the most vulnerable people may not be in the most vulnerable places: poor people can live in resilient physical environments and be vulnerable because of lack of resources and access to basic needs, and wealthy people can be in fragile physical environments and live relatively well because they have more and stable access to resources.

The level of development (in terms of technology and infrastructure) of a specific society is to be considered in a hazard analysis, but still the question of greater or lesser vulnerability among certain groups remains. This relates also to aspects of environmental/social justice and the role to be held by state, civil society, international institutions and the individuals themselves. Social vulnerability, in contrast to being seen as an outcome, is viewed more as a potential state of human societies that can affect the way they experience natural hazards (Adger, 1999; Adger and Kelly, 1999; Blaikie et al, 1994). This potential state is in constant flux, reflecting its dependence on the dynamic interaction of a range of economic and social processes which influence the capacity of individuals, social groups, sectors, regions and ecosystems to response to various socio-economic and biophysical shocks (Leichenko and O'Brien, 2002; Clark et al, 2000; Comfort et al, 1999). The most vulnerable are considered those who are most exposed to perturbations, who possess a limited coping capacity and who are least resilient to recovery (Bohle et al, 1994). Other definitions of vulnerability to hazards and disasters focus on concepts of marginality, susceptibility, adaptability, fragility and risk (Liverman, 1994).

After such arguments we may say that vulnerability and related risks are therefore a function of economic, social, political, environmental, behavioural and technological assets. Who, where, and when vulnerability and disaster will strike, which group of the population is determined by the human and physical forces that shape the allocation of these assets in the society (Pelling and Uitto, 2001).

Method:

In this project, we analyzed the socio-economic parameters of a possible earthquake risk in Odunpazarı district of the city of Eskişehir, in Turkey. Eskişehir is a city with 706.009 people, located in the Marmara region in the Western Anatolia and has experienced the effects of the 1999 Marmara Earthquake. The major aim of this project is to find out the socio-economic

vulnerability of different households and workplaces to the effects of an earthquake. The effects are analysed in three levels: before, during and after a possible earthquake. In the project, a field research was conducted with 1500 households, selected through stratified random sampling, using the database obtained from the Eskişehir Greater Metropolitan Municipality. Interviews were made face to face with one adult person over the age of 18 in each household.

The major dimensions of socio-economic vulnerability used in the research are determined as:

- Socio-demographic risks: age, gender, marital status, migration, household size, number of dependent persons
- Socio-economic risks: level of education and skills, employment status as self-employed or wage or salaried work, seniority in work, size of workplace and investment if self employed, degree and nature of unemployment, levels of income, access to welfare benefits, social networks –social solidarity and reciprocal ties, family pools
- Social security and Insurance
- Behavioural Dimensions: perceptions of risks, attitudes towards disasters and specifically to earthquake risks, political awareness and being organized

If we can explain these dimensions in some more detail :

Socio-economic risks: Socio-economic factors inevitably play a key role in affecting a society's vulnerability: there is a consensus that a strong economy acts as a safety net in the case of environmental risk and hazard exposure, both pre-event through enabling anticipatory coping strategies such as insurance and post-event in responding to a shock (e.g. Cannon, 1994; Burton et al, 1993). Individuals with good access to resources arguably have a safety net in the case of environmental risk and exposure, allowing them to draw on other resources to maintain their livelihoods, and hence widening the range or intensity of hazards with which they can cope.

Migration: if there is a high rate of urbanisation caused by rural-urban migration it is highly likely that the new migrants to the city will also be increasing their personal vulnerabilities by leaving behind the social networks and collective institutions that might have facilitated adaptation (Adger, 2001; Moser, 1996; Rittersberger-Tılıç and Kalaycıoğlu, 1998; Erman, Kalaycıoğlu, and Rittersberger-Tılıç, 2002).

Socio-demographic risks: age is an important consideration as the elderly and young tend to be inherently more susceptible to environmental risk and hazard exposure (O'Brien and Mileti, 1992). Age is an important consideration as the elderly and the very young tend to be inherently more susceptible to environmental risk and hazard exposure (O'Brien and Mileti, 1992).

Social risks: Having social security means coverage by the social insurance system in Turkey. Type of insurance schedule is also very important. Thus, it is closely related with the vulnerability. In Turkey social insurance coverage is fragmented (despite the new reform laws) and the best coverage including almost 80 % coverage of health expenses are given to the civil servants. Then comes the workers and their social insurance where coverage of health is not full. Third type of social insurance system is for the self-employed where their health coverage is not guaranteed and retirement benefits are very limited. All in all almost 85 % of the population have some form of coverage for retirement and health. The rest have no coverage at all since coverage is also dependent on the form of employment. Hence, unemployed or underemployed in casual, seasonal and unregistered jobs are the most at risk and vulnerable to any disaster or hazard (Kalaycıoğlu, 2006).

Public infrastructure: A well-connected population with appropriate public infrastructure and public investments will be able to deal with a hazard effectively and reduce, if not stop completely, the biophysical effects translating into human impacts (Handmer et al, 1999).

Behavioural Dimensions: This dimension mostly refers to the perceptions of risks of hazards by the population and developing appropriate attitudes for taking precautions against earthquakes. People may be living on fragile environment for earthquakes (or other hazards) however, if they have a high level of awareness before about taking precautions, if they have coping strategies during the time of the disaster and if they have developed safety nets and social solidarities after the earthquake, then this group of people are much more resilient to the effects of disaster (Sen,1981).

Table one : A summary of major dimensions, variables and the indicators used in this research

Name of the Vulnerability	Component indicators	Indicators represented in the research are	Hypothesised functional relationship between indicator and vulnerability
Economic	Poverty Housing ownership Income	population below poverty line, absolute poverty population under minimum wage	The greater the population below the income poverty line, the greater the vulnerability The greater the renter population, the greater the vulnerability
Demographic	Dependent population Working status	population under 15 and over 55 as % of total, refers to de facto population, i.e. all people actually present in a given area Population working in the informal sector as % of total	The higher the dependent population, the greater the vulnerability. The higher the formal employment participation, the lesser the vulnerability.
Social	The values and norms, social groups, age, gender, social networks and migration	The population in the dependent age and gender differences	The higher the number of very young and very old in the households The migrant

			population is expected to be more vulnerable
Public Infrastructure	Social Welfare, protection, education Insurance, public spending	The number of schools, health centers	The higher the uninsured population the greater the vulnerability. The higher the number of schools and health centers the lower is the risk
Behavioural	Individual coping strategies, solidarity, individual preparedness to earthquake.	The precautions taken at homes How help is coordinated during earthquake	The higher is the awareness and precautions less is the vulnerability. The higher number of insured houses lower vulnerability.

Collected data is analysed with factor analysis and socio-economic and cultural vulnerability index is calculated. The indicators below are found to be the most dominant in the determination of socio-economic vulnerability index.

Discussion of Findings:

- 1) **Age factor and Dependent Population:** From the data analysis the population between 0-14 is mostly concentrated in Karapınar (M37) neighbourhood. The population over the age of 55+ is also mostly concentrated in this neighbourhood.
- 2) **Social Security and insurance:** A distribution of population among different social insurance schemes is seen among the neighbourhoods. Analysis displays that civil servants are mostly concentrated in Paşa neighbourhood (M48) with highest insurance coverage. All the other neighbourhoods have been also included into the insurance schemes for workers and the self-employed but no such concentrations are seen. In fact, this shows us that most of the population in Eskişehir province Odunpazarı district have some form of social insurance coverage. However, (M 37) is among the neighbourhoods which do not have any social insurance coverage though it has highest number of dependent population (0-14 and 55+).
- 3) **Homeownership:** This is an indicator for economic dimension. In Turkey in general 80% of the population are homeowners. Homeownership is highly valued. The quality of the houses are not included in this indicator. In Eskişehir Odunpazarı district we see that high concentration of homeownership is found in Paşa (M48) again. This together with the social insurance coverage shows that civil servants are the most advantageous section of the population economically. On the other hand, Karapınar (M37) is the neighbourhood where the population mostly lives in rented accommodation. As mentioned above, this

neighbourhood has high concentration of dependent population, no social insurance coverage and they live in rented accommodation.

- 4) **Income** : is another significant indicator for economic dimension. The lowest income earning section of the population (population earning below or just about the minimum wage in Turkey which is about 270 US dollars monthly) lives in M37, not surprisingly. These are also crowded households with dependent population. Among the places where the highest earning population can be seen, we again see (M48) the neighbourhood of civil servants.
- 5) **Education**: Attainment of university education in Turkey is low, about 5% in general. Among the neighbourhoods of Odunpazarı District, the highest level of education, namely university education, is seen in M48. So this is the neighbourhood where civil servants live with higher wages and high home ownership. The lowest level of university education is in M37, the neighbourhood where people who earn below minimum wage, who have no insurance coverage and live in rented accommodation.

Conclusion

Age at dependency level, Social insurance coverage, homeownership, level of income and level of education, are found as the major indicators determining the level of awareness of risk and being prepared for a possible earthquake. In fact, among 55 neighbourhoods of Odunpazarı District, people living in M37 and being poorest in all indicators, are the most vulnerable population. They can be said to be the population mostly at risk in time of an earthquake, especially in all three stages of the earthquake. On the other hand, the population in M 48, having higher achievements in all five indicators, can be vulnerable during and after the earthquake since they are mainly homeowners. However, their main risk is economic whereas for the people in M37 the risks are more widespread, economic, social and cultural.

In our study we also found relative poverty due to social networks criteria, which presented a risk before and after the earthquake. Thus, during the earthquake, social networks of the individuals, though seemed to be disintegrated to some extent, was found to be the most significant indicator, providing the people with a variety of support facilities. Some networks mechanisms decreased the effect of disaster and supported the coping strategies of individuals (Kalaycıoğlu and Rittersberger- Tılıç, 2000). However, reliance on social networks also presented a risk and vulnerability for the households if there are no other coping strategies.

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