京都大学防災研究所年報 第 55 号 B 平成 24 年 6 月
Annuals of Disas. Prev. Res. Inst., Kyoto Univ., No. 55 B, 2012

Role of Social Networks in Community's Flood Risk Perception and Mitigation Behavior: A Case Study from Mumbai, India

Subhajyoti SAMADDAR and Hirokazu TATANO

Synopsis

Risk awareness and preparedness attitude are important elements to disseminate flood disaster preventive measures in a community. This study examines how social networks influence individuals' risk awareness and preparedness values. This study is based on the filed survey conducted in flood prone micro-hot slum areas in Mumbai. Results show cohesive groups play important role in shaping individuals' risk perception and preparedness intention. In other words, individuals share similar risk perception and preparedness values with whom they closely interact in day to day. The role of structurally equivalence group is negligible as found in the study. We did not find any impact of socio-demographic characteristics on individuals' attitude formation.

Keywords: Social Networks, Flood Preparedness, Mumbai

1. Introduction

It is evident that adoption of innovative household preparedness measures or practice is inevitable for improved disaster risk preparedness and management. If more and more individuals or households adopt the prescribed disaster preparedness measures, for example raising plinth level and store drinking water and foods during monsoon season to reduce flood risks, the resiliency capacity of the community will improve. However, recommended disaster preventive actions or measures are new to the community, they do not know the advantages and disadvantages of the new technology, and therefore, the decision to adopt is an uncertain issue (Rogers, 1983). Researchers and scholars have shown that in the process of adopting preventive action, individuals go through two different phases or stage before they take adoption decision. These two stages are risk appraisal and coping appraisal (Ajen, 1990). Risk appraisal is a process in which an individual assess a risk possibility and damage potential to things he or she values, assuming no changes in his or her own behavior. If an individual beliefs the hazard can adversely affect him or her, individual will look forward to find out possible options, actions and measures to reduce and mitigate the risks. The fear engendered by perceptions of risks cause people to assess to possible coping strategies (Rogers, 1997). This process is called coping appraisal. Studies have identified two interactive factors including risk perception and preparedness values as most observed influencing element in shaping the derived adoption patterns of disaster preventive measures. Public awareness programme often assumes that only providing information about disaster preparedness to the community through various mass media will motivate people to adopt disaster preparedness measures or to pursue disaster preparedness action. However, evidence from several sources shows that though lots of money were spent and lots of project were undertaken to aware people about the disaster risk and to make them aware about the possible and potential disaster preparedness actions, the level of preparedness or intention to adopt it remains low (Duval and Mullis, 199; Paton et. al, 2001). So far, many studies have

added to our understanding of the role and factors determine risk perception and preparedness values (Rogers, 1983; Ajen, 1990; Solvic, 1997), yet in all such studies perceived risk and mitigation behaviors had been studied and considered in the light of individual cognitive mechanism. In other words, individual collect and process information and develop perception of risk and benefit as atomized units connected to asocial system (Scherer and Cho, 2003). Social Network theory suggest that it is the relational aspects of individuals of individuals and resulting networks and self organization systems that should be units of analysis rather than individuals and their isolated cognitive structure and processes. Frequent interaction or social roles provide shared contexts for interpreting prior behaviors and attitudes that influence subsequent attitudes (Samaddar and Okada, 2008). Becker (1970) mentioned to make adoption decision of new technology, social networks help an individual in three ways – First, to provide information about the innovation which otherwise an individual might have missed; second; Second, to provide social support of an individual's adoption decision and thus to legitimize the innovation; Third, to create social influence on an individual to accept or reject the innovation. But in the process of diffusion of disaster preventive actions, individuals receive information from many others and also get influenced. But now the question is that who is adopter's social referent and in which occasion? Who receives what type of information from whom or who passes what type of information to whom? Diffusion studies, specifically social network studies found that individuals are influenced by many actors in the social system or networks (Valente, 1995). An individual are informed by various actors and also from various sources. Based on the social network theory, we examine the role of two social network groups –

a) Cohesive group or network –

The cohesive group is determined by the degree of interpersonal contact or tie. An individual may have various direct and indirect social ties with others in a network or in a community, but his/her cohesive group is comprised by those with whom he/she has the highest social interaction (Figure 1). The cohesive research states that frequency, intensity and proximity of interaction among cohesive members generates greater information sharing than it does among non-cohesive members and therefore, cohesive group offers opportunities to learn about an innovation and also impose constraint among the members to adopt about an innovation (Valente, 1995).

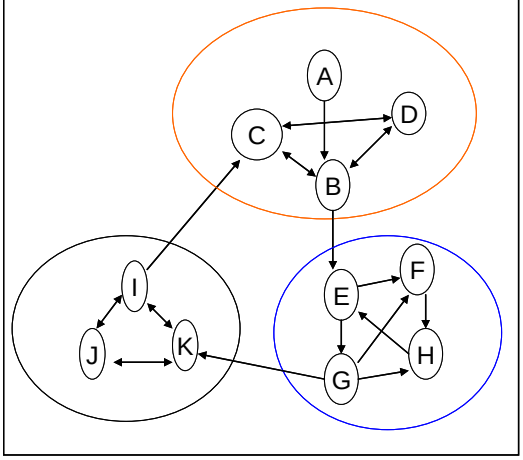

Fig. 1 Categorization of Groups based on Cohesion in a Social Network

b) Structurally Equivalent group –

Structural equivalent actors are those who share a similar pattern of relationships (from and to) with others and thus occupy the same position in a network. Importantly, the members of a structurally positioned group or class members may or may not direct ties with each other. Structural equivalence theory invokes that people are influenced by others with whom they share similar position in the network (see Figure 2). Social environment, competition, socialization process all has be defined under the structural equivalence theory (Burt, 1987).

c. Socio-economic group –

In the diffusion of the innovation, information sharing activities are subject to adopters' characteristics and attributes of innovation (Becker, 1970, Coleman et al., 1957, Rogers, 1983). Socio-economic characteristics like age, educational attainment, economic well being, cosmopolitanism etc. create constrains and opportunity to have access to information and also

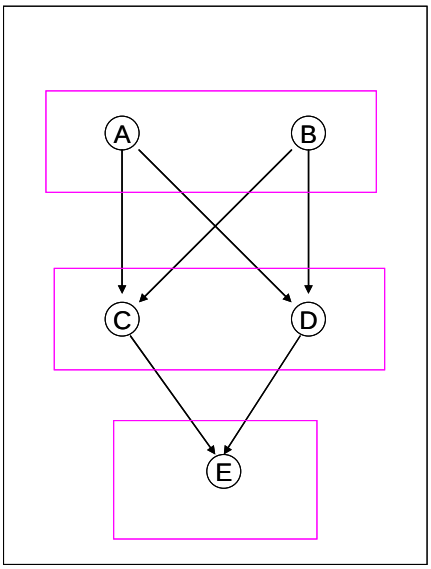

Fig. 2 Structural Equivalent Groups in a Social Network

their adoption behavior. The extent and manner information shared between the individuals also depend on socio-economic affiliation and attachment. Therefore we also examine the individuals' socioeconomic characteristics.

This study examines who is individuals' social referent for risk perception or awareness and preparedness attitude. In other words, to reach to a certain risks perception and to develop preparedness intention, individuals depend on which group of individuals in their social environments.

2. Background

On 26th July, 2005, Mumbai, the financial capital of India, experienced one of the worst floods in its history. Within a span of less than 24 hours, it had received 940mm rainfalls, which crippled transportation, telecommunications, and power services and halted the entire commercial, trading, and industrial activities for days (Government of Maharashtra, 2006). It was an urban flash flooding. Water level rose rapidly within three four hours, submerging the roads and railway tracks, all the low-lying areas in the city were heavily tracks. More than 60 % of the city area was directly or partially affected due to the 2005 flood (Gupta, 2007). According to Fact Finding Committee of Mumbai Flood (Government of Maharashtra, 2006), at least 625 persons died and 233 people drowned in this flash flood. It had been reported that that 100,000 residential and commercial buildings collapsed, 30,000 vehicles were damaged. Death toll and property damage increased mainly due to building collapses, which can be avoided or minimized by household preparedness measures. Poor household preparedness was also responsible for loss and damage to vital documents including ration card, educational certificate, voter identity card, residential proof etc., which are critical assets having direct and indirect influence on community's recovery and revitalization process (Samaddar et al., 2011). It is essential to note that the property and human loss would have been much higher if flood continued for another couple of days (Tatano and Samaddar, 2011). While most of Mumbai crept back to normalcy, the city's most vulnerable population residing in the most exposed neighborhoods of the city was still struggling to survive. Ten days following the first days of the flood, suburban and low-lying areas near the Mithi River remained waterlogged without services, appropriate shelter, potable water or food. This area, 70% of which is occupied by slum and pavement dwellers, received limited attention from the government both prior to and following this disaster (Samaddar et al., 2011).

3. Methodology

Data of the present study were collected by conducting primary surveys in April and May, 2011 in a flood prone slum community, called Parshichawl, in Dharavi, Mumbai. The site selection was done after extensive consultation with local city authority (G/North Ward, Municipal Corporation of Greater Mumbai (MCGM)), local leaders, and volunteers. Parshichawl is a slum with 20000 inhabitants, where 25 houses were damaged in 2005 flood. The area is quite homogeneous, majority of them are Marathi speaking Hindu community living here for more than 50 to 60 years. The level of flood water was to 5 to 6 feet in average, and approximate average household damage in 2005 was equal to 30,000 INR (550 USD) , which is almost double or triple their household monthly income. Like all surrounding

slums, the settlement is low-lying, 2 to 3 feet below from the main road. Yearly local water logging problem is common. Inhabitants in both communities are engaged in informal sectors like recycling factory, leather industry, hawker, wage labor etc.

A total 40 households were randomly selected for the interview. Some background information about the respondents follows –

- Majority of the respondents are male (because our target respondents were heads of the households.

- Median age of the respondents was 37 years (SD 9).

- Average monthly income of the households was 7800 INR (140 USD).

- Respondents educational background: 16% - illiterate – 16 %; Primary school education (up to class IV) – 3 %; Junior High School education - 23 %; High School (XII class) – 44 % and college education (under-graduation) – 4 %.

- There were only two religious group – Hindus – 82 % and Muslims – 18 %.

Face to face structured interviews were conducted to obtain data for the present study. The heads of the households, in view of the fact that they are the decision makers of households, were interviewed. Nevertheless, due to explanatory and expounding nature of questioners, elderly and illiterate respondents were deliberately excluded. All the interviews were conducted at the respondents' homes. As the heads of the houses were target respondents who were usually not available in daytime, surveys were conducted either in the evening in weekdays or daytime in weekend (Sunday). The language used during the interview was Hindi. Students from Tata Institute of Social Science, Mumbai, who are trained to conduct field survey and having prior data collection experience were recruited and trained over a week period involving lectures, mock interviews, and pretests to ensure quality of data. The field procedures were also closely monitored by the principal investigators and onsite team leaders (including the first author of this paper) to ensure that field assistants adhered to the procedures laid down.

Present study examined two dependent variables – a) General risk perception, b) Preparedness Value.

General risks perception was measured by summarizing two items – perceived risk probability and perceived vulnerability. Perceived risk probability was measured by asking the respondents to report their judgment or intrusion about possibility of flood occurrence: "Do you think flood like 2005 can occur again in Mumbai?" Risk Vulnerability was measured by asking the respondents to report their self judgment about their own level of vulnerability: "Do you think flood can be risky for you and your family?" Both questions were measured in five points scale starting from "definitely" = 4 to "never". = 0.

For general preparedness attitude, respondents were asked, "Do you feel with proper countermeasures flood risks can be managed"? Scores were collected in five points scale - "With the development of science and technology it is 100 % possible to mitigate flood risk" =4; "With proper countermeasures there is high possibility to mitigate flood risk" = 3, "I do not know (50-50 chance)" = 2 ; "Chances of any countermeasures to mitigate flood risk is very low" = 1; "Man cannot control flood" = 0.

The measures of independent variables included in this study are followings –

To group the adopters according to their social ties, we collected socio-metric data on adopters' personal interaction in day to day life. For this, respondents were asked – "kindly name us three individuals in your Parshichawl community with whom you most often interact, meet and share sparse time in your daily life". Matrix was formed same way as done for other social matrix.

Characteristics of individuals – we have collected following socio-economic information of respondents income, education.

By using matrix of respondents interpersonal ties in daily life, we have categorized the adopters into structural equivalence and cohesion. A) *Structural Equivalence* – we determined structural equivalence using a block modeling procedure, CONCOR (Convergence of iterated correlations), a subordinate found in UCINET. This positional clustering technique identifies groups of actor with relationships that are similar in terms of correlations between ties and divides them into blocks. We have divided the networks into 8

structural equivalent groups (see Appendix 2 for details). B) *Cohesive group* - The cohesive group was determined by using "Faction" techniques by running a computer programme of UCINET. The procedure is to partitioning of a binary network of adjacencies into n groups, then a count of the number of missing ties within each group summed with the ties between the groups gives a measure of the extent to which the groups form separate clique like structures. The routine uses a tabu search minimization procedure to optimize this measure to find the best fit. (See Appendix 3 for details).

We use UCINET's Quadratic Assignment Procedure (QAP) multi regression techniques to find out the actors' social referents for each kind of information seeking activities. This approach is similar to ordinary multiple regression; however, it enables analysis of matrix data.

4. Results and discussion

Table 1 shows that individuals' flood risk perception are influenced by two factors – their past flood exposure or loss and the perception of their cohesive partners. Same two variables have found important for developing and shaping flood prepared value. Therefore, as hypothesized, results show that people risk perception and flood preparedness are shaped and influenced by the idea and attitude of the group or group of individuals with whom individuals often turn for discussion and suggestion in their day to day life. However, since the structural equivalence groups are not significant predictor of risk perception and preparedness, it can be argued that socialization process of individuals did not play much role in the flood mitigation attitude formation. Interestingly, it is found that income, education and native place had not significant impact. It means people cohesive group does not restrict within income and education, rather it has some larger social boundary.

The present study is an attempt to show how individuals' risks perception and preparedness intention are influenced by the nature and structure of social networks they possess. The study conducted in Mumbai slum areas affected by flood risks, shows that social networks, particularly direct ties are significant factor of shaping coping capacity of the community. If majority of the individuals in a group believes that flood is imminent and preparedness is inevitable, such opinion influence and insist others to prepare for imminent flood risks. However, present study data is very less and homogeneous; a similar study must be conducted in larger number of samples and among heterogeneous community.

References

Ajzen, I. (1991) : The theory of planned behavior. Organization Behavior and Human Decision Processes, 50: pp.179 – 211.

Becker, M. H. (1970) "Socioeconomic location and innovativeness: Reformulation and extension of the diffusion model," American Sociological

Table 1 Results of Regression analysis on social Referents for Risk Perception and Flood Preparedness Value

Group Criteria		**Risk Perception / Awareness**	**Flood Preparedness Value**
Cultural and Economic Group	Education	.007	.012
	Income	.001	-.001
	Native Place	.017	.022
Flood Exposure	Total Monitory Loss	.028*	.031**
Social Networks	Cohesive Group	.065**	.051**
	Structural Equivalence Group	.026	.018
R- Square		.074	.056

** p < .01 ; *p < .05

Review 35, pp. 267 – 282
Burt, S. R., (1987) : Socaial contagination and innovation: Cohesion versus structural equivalence, , The American Joural of Sociology, Vol. 92, No. 6, May, pp. 1287 – 1335.
Coleman, J.S, Menzel, H and Katz, E. (1957): The diffusion if an innovation among physicians, Sociometry, Vol. 20, pp. 253-270.
Duval, S. T. and Mulilis J. P., (1999) A Person-Relative-to- Event (PrE) approach to negative threat appeals and earthquake preparedness: A field study. Journal of Applied Social Psychology, 29 (3):pp.495 – 516.
Government of Maharashtra (2006) Report of the Fact Finding Committee on Mumbai Floods, Unpunished.
Paton, D., Millar, M. and Johnston, D. (2001): Community resiliency to volcanic hazard consequences. Natural Hazards, 24: pp.157 – 169.
Rogers, M. E. (1983): Diffusion of innovations, The Free Press, New York.
Rogers, R. W. and Prentice-Dunn, S. (1997): Protection Motivation Theory. In: D. S. Gochman (Eds.), Handbook of Health Behavior Research. I: Personal and Social Determinants. New York, NY: Plenum : pp.113–132.
Samaddar S. and Okada, N. (2008): Modelling and analysis of rainwater harvesting technology disseminating process based on Social Networks Threshold Approach, IEEE International Conference on Systems, Man, and Cybernetics, Montreal, Canada, pp.1494 – 2501
Samaddar, S., Chatterjee, R., Misra, B. A., Tatano, H. (2011) Identifying vulnerability pattern in a flood prone micro-hotspot of Mumbai, India. 2011 2nd International Conference on Environmental Science and Development, IPCBEE, Vol. 4, IACSIT Press, Singapore
Scherer, C.W. and Cho, H. (2003) : A Social network Contagion Theory of Risk Perception, Risk Analysis, Vol. 23 , No. 2 , pp.261 – 267
Tatano, H. and Samaddar, S. (2010) Flood risks reduction in livelihood risks : Thoughts and insights from Mumbai. Annuals of Disaster Prevention Research Institute, Kyoto University, 53 B, http://www.dpri.kyoto-u.ac.jp/nenpo/no53/ronbunB/a53b0p12.pdf
Valente, T. W., (1995): Network models of the diffusion of innovations, Hampton press, INC, New Jersey.1995.

コミュニティの洪水リスク認知と軽減行動によるソーシャルネットワークの役割
：インドムンバイを対象として

サマダール　サブハジョティ・多々納裕一

要　旨

リスクの存在を気付かせることや備えることは洪水予防措置を伝播するための重要な要素である。本論文はソーシャルネットワークが個々のリスク認識や備える基準にどのように影響を与えるかを試みた。現場調査は洪水の起こりやすいムンバイのマイクロホットスラム地域で行われた。人間関係が密着しているグループは個人のリスク認知や準備に重要な役割を果たす。本論文の結果によると人は日常において関係が深い人と類似したリスク認知と準備価値を共有する。しかし構造的に同等なグループにそのような役割はあまりない。そして個人態度の形成においては，社会人口統計学の特色な影響は見つからなかった。

キーワード: ソーシャルネットワーク，洪水対策，ムンバイ