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Social networks in the context of community response to disaster: Study of a cyclone-affected community in Coastal West Bengal, India

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ABSTRACT

The strength and effectiveness of social networks influence the ability of communities to cope with disaster events. Social Network Analysis (SNA) provides scope of analysing such complex networks in disaster-hit communities. We describe the application of SNA in a disaster-hit community and show the changing pattern of evolving networks during and after the disaster. The disaster event was conceptually divided into four distinct phases namely 'extreme event' (Phase-1), 'immediate community response' (Phase-2), 'relief' (Phase-3) and 'rehabilitation' (Phase-4), through a series of focus group discussions with the community. We also considered the Pre- and Post-disaster phases for before-after comparison of the community's social network. Network data for all these six phases was collected through personal interview from the affected households located besides the river embankment. For all the six phases, unique networks were found with different central nodes, although few nodes remained central in more than one the phase. Different measures of network density and mean network centrality increased from the pre-disaster stage in Phase-1, just after the disaster event, and then consistently reduced from Phase 2 to Phase 4. Then again they increased at the post-disaster phase. While the Phase-1 was characterized by endogenous nodes and ties, during the later stages, the networks assumed a core central structure constituted of both internal and external nodes, with peripheral components. The internal and external central actors maintained link between local (friends, relatives, neighbours) and external (institutional) entities. The analysis illustrates the interactions within and between community networks, and may initiate situational awareness, efficient planning, and optimal resources allocation for disaster preparedness, community resilience, and response.

1. Introduction

Community resilience against natural disaster needs social assistance such as information, material, services and support. Such assistance is embedded in social relationships constituted of family, neighborhood, workplace, and the community itself through which assistance flow to its members. The strength and effectiveness of such social networks influence the ability of communities to cope up with and recover from disaster events. Social support studied in the context of disaster and disaster resilience includes emotional support e.g. listening, positive encouragement, or tangential support, e.g. help with clean-up, sheltering, and rebuilding [34]. Enhancement of both types of support through personal social network increases individual resilience to disaster [32,43].

Sociologists in recent years have started to focus on the importance of "social networks" in disaster studies. This can be appreciated within the rich tradition of scholarship on social capital. The conceptualization of social capital involves both individual and group [40] and even the whole country [41]. Putman (1993) understands social capital as networks, norms, and social trust that facilitate coordination and cooperation. Structuralists observe that social capital is resources embedded in social structure that can be accessed or mobilized to achieve collective goals [29]. Social capital of an individual level is conceptualized as the personal social networks of family, friends, neighbours, acquaintances, and organizations, whom he perceives as potential or actual provider of assistance during and/or after disaster [34]. It has two clear components mainly identified by disaster researchers - a 'durable' social network and the amount and quality of available resources to be passed through the network ties [29]. Such conceptualization of social capital often focuses on how social ties

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Table 1
Important literature on disaster studies vis-à-vis social networks.

Author and year	Type of tie information/ material/services	Unit of analysis (individual/ community/institution)	Operationalization
Comfort and Kapuju (2006)	Information	Institution	Objective: To identify the network of organizations that emerged in response to Hurricane Katrina. Network analysis: Patterns of interaction among the organizations. Measures for individual actors: Degree Centrality, Closeness Centrality, Betweenness Centrality, Cliques Identification
Varda et al. [48]	Information, Material, Services	Individuals, community	Objective: To identify disasters and the impact on both individual and community level networks. Measurement of Ties Characteristics: Indirect links, Frequency, Stability, Multiplicity, Strength, Direction, Symmetry (reciprocity) Measurement for individual actors: Degree, In-degree, Out-degree, Range (diversity) Closeness, Betweenness, Centrality, Prestige, Brokerage Measure to describe networks: Size, Inclusiveness, Component, Connectivity, Connectedness, Cohesion, Density, Centralization, Symmetry, Transitivity
Kapucu et al. [24]	Information, Material, services	Institution	Objective: To find the performance of intergovernmental and intra -organizational response to the catastrophic disasters in 2005. Measures to describe Network: Centrality measures, Dyadic cohesion measures, Positional analysis algorithms, and Clique
Kapucu et al. [25]	Information, Material, services	Institution	Objective: To identify the major organizations that participated in the response operations and in the interactions among organizations Measures to describe Network: Degree Centrality, Closeness centrality, Betweenness Centrality, Cliques
Cassidy and Barnes [10]	Information, Material, services	Individual	Objective: To identify the network of organizations that emerged in response to Hurricane Katrina Measures to describe Network: To examine patterns of interaction among the organizations. Measures to describe Network: Frequency, Distribution Degree Centrality, Closeness Centrality, Betweeness Centrality, Cliques Identification
Lassa [27]	Information	Institution	Measures to describe Network: Network diameter and degree distribution, Sums of degree, Out-degree, In-degree and total sums of actors. Degree-In-degree and out-degree. Degree, centrality, Degrees of separation
Zhao (2013)	Information, material, services	Individual, group	Measures to describe Network: Measurement of the Core Size Composition & Structure, Deterioration of Networks, New network members Relational analysis: Logistic regression of likelihood (social networks to get information after the earthquake) Ordinary least squares regression (factors influencing the amount of support received and of the factors influencing the mental health status)

affect resources and facilitate the flow of support offered to disaster survivors [37,49], or how emergency and social service organizations collaborate during disasters [22]. Social researchers identify financial such as loans and grants for property repair, and non-financial resources such as search and rescue, food, safe drinking water, health service, emotional support, shelter, information that can be transferred through social ties and improve resilience [34]. The evolution of social networks and their transformation at different points of time after the disaster events puts light into the social structure and social processes in a disaster-hit community [51]. This helps to mitigate the social impact of disasters as a long-term objective.

The tropical cyclone Aila, also known as 'Severe Cyclonic Storm Aila' was the second tropical cyclone of 2009 in the North Indian Ocean cyclone season [5] causing extensive damage in India and Bangladesh. In West Bengal, the affected districts were East Midnapore, Howrah, Hooghly, Burdwan, South 24 Parganas, North 24 Parganas and Kolkata and Sunderbans region of South 24 Parganas and North 24 Parganas, 75 per cent of the sufferer being from these regions. Approximately, 9,20,000 houses were damaged, majority in the Sundarbans region. More than 100 river embankments were breached by storm surge in Sagar, Pathapratima, Basanti, Gosaba, Sandeshkhali and Hingalgunj Blocks. The saline water that broke through embankments, flooded the villages, destroyed mud houses and polluted rice fields, submerged crops, uprooted trees, shattered homesteads, washed away seeds, killed the livestock, and ruined freshwater fish and shrimp. Overall, it killed 137 people and affected the lives of more than seven lakh population [11,12,36]. Affected people were left with acute shortage of drinking water, food and shelter. We argue that such huge loss of social infrastructure and livelihood options are bound to trigger evolution of new networks, besides traditional social networks, in the affected areas. Such context-bound networks in disaster-hit communities are of serious academic interest, apart from being strategically important for managing disasters.

Social network theory is flexible and applies to many kinds of networks, wherever there is a system boundary, tangible actors and defined interactions or relationship among them. The networks can either be egocentric or whole networks involving individual, community, and organizations. They can involve different set of actors and relationships. However, the atypical structure of networks after the disaster and the nature of links (such as sharing of relief material) make the application of SNA extremely challenging in disaster contexts [49]. Although the application of SNA is relatively new in the context of disaster resilience, a trend could be anticipated through a systematic review of existing literature. This might help one to answer the questions: Why are social networks important in studying disaster recovery at the individual and organizational levels? And what methodologies are employed to study social networks in the context of disaster resilience? To answer this, we reviewed more than 30 research papers related to this study. After screening for redundancy, we list 8 distinct and representative research works which demonstrate the importance of SNA in disaster study (Table 1). One may observe that analyses of these literatures have covered individuals, community and institutions as the study units, and the interaction among study units has been understood in terms of information, materials and service flows among them. However, methodology of these studies differed to certain extent. Content analysis and SNA are often used in combination, covering the evolution of institutional network and characterization of the network actors. We identify that although application of SNA has started to catch up in the field of disaster research, the study of network evolution and their characterization has remained extremely limited. Moreover, the study of changes in pre- and post-disaster social networks is also an outstanding issue in the related literature. We address both these issues in the present research.

The limitation of explanatory power of social capital has often been debated and researchers have argued that social capital's explanatory potential is best harvested when other factors are also taken care of while explaining institutional performance and collective action. In the context of network analysis, the concept of agency may be taken up, which is realized through the existence of agents (e.g. influential actors) in the network, who mobilise social capital to produce sustained flow of