

# The effect of social network structure between provider and user of critical infrastructure on the community disaster recovery: Experimental evidence

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In a disaster-affected community, the service quality of the critical infrastructure (such as providing water, energy, housing, transportation, etc.) can influence the process of community recovery. There are two potential problems associated with the provision of infrastructure service in a disaster situation. First, if there is a single provider, the service level may decrease due to underinvestment by the provider to maximize its own benefit. Second, there is uncertainty in the service level because of the impact of disaster. If users are satisfied with the service level despite considering the above two aspects, users continue to use the provider's service and remain in the affected area. When users are not satisfied with the service level, users can counteract either at the individual or collective level. First, users can move out the community at their own relocation expense (Exit). Second, users can collectively appeal for service improvement to the provider with costly petition (Voice). Both Exit and Voice options can restrain the lapse of appropriate investment by the provider, but it is hypothesized that the strong social network in the community discourage people to exit individually and encourage collective action through voice. This hypothesis has been supported by case studies and statistical models, however, not by the results from human-subject experiments. Further, it has been unknown which type of social network structures among the provider and users will be the most effective on the service level of infrastructure and the disaster recovery process. We conducted an online behavioral experiment to empirically test the hypothesis. Our experiment was designed for the real-time strategic decision game consisted of one provider and three users. It has four treatments concerning the social network structure: 1) no network, 2) a ring network among only users, 3) one-to-one networks between the provider and each user, and 4) a fully connected network. The results showed empirical evidences for the effect of different social network structure on the provider-user interaction. It revealed the importance of understanding the existing social network in the community and suggested policy implications on how to facilitate the social network for the desired structure.