

The Role of Social Capital and Social Networks in Resilience

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Abstract: While many organizations and governments now mention an interest in building cities' resilience to sudden and acute stressors such as natural disasters and climate change induced flooding, most of them continue to stress the role of physical infrastructure in mitigation. While seawalls, water proof buildings, and other structures are helpful, they cannot provide protection from a wide variety of crises. I focus instead on the role of social infrastructure, especially trust, civic engagement, and neighborliness, in mitigating the risks from all kinds of shocks. Using qualitative and quantitative data from Japan's compounded 3/11 disasters, I show how communities with deeper reservoirs of social capital had higher survival rates and faster recovery rates. Given that social capital, like other forms of capital, can be strengthened and created, I also show the results from field experiments we have carried out around the world which have measurably increased levels of trust and efficacy.

Introduction and Summary

Extreme weather events such as flooding, mudslides, and hurricanes are and will continue to be major hazards for developed and developing nations across the globe. The number of people affected by disaster and the costs of disaster recovery continue to rise (EM-DAT 2017), and our modeling of anthropogenic climate change indicates that rising seas and higher temperatures will create more regular severe hurricanes and typhoons. Disasters kill and displace more people than front page headline events such as terror attacks. The impact of these events will be magnified by the choices of residents, authorities and developers, such as building habitations in vulnerable, highly dense areas like coastal and flood zones. Megacities remain at the frontier of these challenges, but small and medium sized cities such as Bangalore, India have fewer available natural resources, rapidly growing population, and less policy attention (Birkmann et al 2016; Subramanian 2017). In short, cities will be the front lines for policies which seek to respond to a variety of risks.

While disasters grow in strength and impact, societies continue to focus on narrowly defined areas of disaster mitigation. Specifically, most spending by disaster managers and elected officials supports physical infrastructure seen as limiting the effects of potential disasters and extreme weather. In Japan, this money has gone into seawalls and concrete tetrapods which have not effectively reduced mortality from tsunami (Aldrich and Sawada 2015). In North American communities, such as New Orleans, investments have been focused on water protection systems such as levees and dykes. Yet a growing field of research illuminates that social infrastructure, more than physical infrastructure, holds the key to resilience (Aldrich 2012; Aldrich and Meyer 2015) and climate change adaptation as well (Aldrich, Paul, and Page 2016)

How Social Capital Works

Connections between individuals who are quite similar are known as bonding social capital. These links bring people together who share the same language, ethnicity, religion, education, and norms; these individuals may be family members, classmates, or long term

friends. Often we connect to people who are different from us, perhaps through a faith based organization, school, or workplace. Connections to people with different characteristics are known as bridging social capital and often occur through institutions such as synagogues, sports clubs, or neighborhood associations. These ties, sometimes referred to as weak ties, are quite useful in that they can bring in information from outside one's normal echo chamber to help spur innovation and find a job. Finally, linking social capital involves the connections between regular citizens and those with power and authority, perhaps in a private sector organization in or a government office.

Strong social ties save lives and accelerate recovery through three main mechanisms: exit and voice, informal insurance / mutual aid, and collective action. Following a disaster, survivors must decide whether to return to damaged homes and businesses or start life afresh elsewhere. Rebuilding a damaged home or business has high costs, including opportunity costs (incurred from not immediately reopening a business in a location with sufficient clients), financial costs (given the gap between private insurance and home reconstruction costs), and psychological costs (the mental trauma from seeing a site where one may have lost friends or loved ones). Individuals with strong ties to other residents, with a strong sense of belonging, and with a strong sense of community are more likely to return to a damaged area and work to rebuild. This option, called voice, is used less by those with fewer connections; such isolated or less integrated individuals opt instead for exit.

Then, during and after a disaster, many of the largest challenges cannot be solved by a single person or family by themselves. For example, in order to deter crime in a disaster affected area where police and other authorities no longer have time to patrol, local households may need to create a community police patrol. If only a single family volunteers for the job, there will be insufficient coverage to deter thieves and looters. If all families participate, it will be easier to maintain order in the neighborhood. Similarly cleaning up debris, engaging political decision makers, and other post disaster goals require the participation of the majority of the community. Where social ties are deeper, residents can better overcome barriers to collective action and successfully carry out these necessary tasks.

The final mechanism through which social capital functions involves informal insurance or collective action. After a major catastrophe, typical providers of services, including food stores, gasoline stations, childcare providers, and doctors, are inaccessible. Should survivors need a tool, seek information, or require a safe haven for their children, they cannot fall back on standard providers of these services. Instead, they must turn to neighbors, friends, and acquaintances to access these resources. If they have built ties and expectations of reciprocity before the crisis, borrowing a tool, sharing a bedroom, or gaining information will not be a challenge. Two examples from the 11 March 2011 Great East Japan Earthquake and accompanying tsunami illustrate how these social connections work during and after crisis.

Mr. Tanaka (a pseudonym), a farmer in the Tohoku hamlet of Nishikigura in his late 70s, had been working in his greenhouse sowing carrot seeds when the earth began shaking on 11 March 2011. He first tried grabbing onto the structure to stay upright, but as the shaking continued, he lay flat on the ground. He, like a number of other evacuees with whom I spoke, was not immediately aware of the impending tsunami and did not hear any sirens, cellphone warnings, or radio announcements. "I knew the disaster prevention alarm was announcing something, but other noises interfered, and I couldn't catch the announcement at all." Mr.

Tanaka has a disability which prevents him from being able to walk without assistance, and he stood up and slowly used a walker to return to his home. He and his wife went inside, unsure what to do. Then, his sister, who lived nearby, arrived. "The first person who came to my house was my sister, and she told me, 'Brother, we have to evacuate.' And I told her I'll catch up later so you go on and escape on your own, and let her escape before me. And then, young officers from the neighborhood association (chōnaikai) came to my house and told us to evacuate. They were standing in front of our entrance telling us to evacuate. And that moment, I saw in front of our house, around 150 meters ahead, a lot of water running through the area carrying cars and many other things."

After warnings and his first view of the impending tsunami, Mr. Tanaka and his wife decided to escape via car, but soon after they closed the doors and tried to drive off were caught in the tsunami. Their attempts to exit the car were futile. "We tried to break the car's window, and we tried so many times, but the window wouldn't break. I tried hitting it with my normal cane, but it didn't work. But we also had an aluminum cane, so we used it to break the car window, and from that exit, I got my hand out and, and grabbed on to the pole of the greenhouse and the line, there is this line that connected with a solid anchor, and we attempted to wait until the strength of the flowing water decreased. And once we waited for a while, the water level decreased, so we tried to go back home, but this time the car didn't move." The water had either short circuited the electrical systems or choked the tail pipe. In any case, the car was dead and they were trapped inside by the debris.

While they were eventually able to break car a window, the couple were still unable to find a safe way to navigate the water. A neighbor came to the rescue. "But then, there was a man who climbed up the roof of our house. This person was the young man from the neighborhood association who had come to our house and told us to evacuate. There was more and more debris coming towards our house, and the young man was able to go up the roof by climbing up the stacked debris. This young man saw us from the roof, and he came down from the roof, and carried us both on his back from the car and helped us. We were saved because there was a third person, but if there were only two of us, then we might've not been able to make it, for sure." Carried into the house, Mr. and Mrs. Tanaka moved up to the second floor to escape the water pooling on the first floor. They spent a difficult night there.

"Next day, early in the morning, the Self Defense Force people came to us on a boat. And they called from outside and asked if there were anyone in the house. The young man who saved us responded by saying there is one disabled person and two others. Then they (SDF) replied that they will bring the helicopter to rescue us. Soon the helicopter came above us, and we were carried out from the window at the hallway of the second floor. We were all carried to South Miyagi Medical Center in Ōgawara." Mr. Tanaka, his wife, and the neighbor were taken via helicopter and treated by doctors. He later learned that three people in his neighborhood had died (Interview with Mr. Tanaka, 24 July 2011). Mr. Tanaka's survival can be attributed to help from others. In another case following the Tohoku disaster, a businessman's exit vs. voice decision was heavily influenced by his social network.

In the town of Rikuzentakata, Japan where 10 percent of the population was killed and 80 percent of the businesses washed away by the 3/11 tsunami, a baker named Mr. Sato (a pseudonym), has been willing to return to the destroyed area to bake sweets, breads, and snacks for his community. He returned cognizant of the fact that turning a profit was unlikely

and that his start up costs would be high. Rather than returning because of his love for business or because he had no other options, he moved back to his hometown because of his personal ties to the area. Sato had saved his own life and that of his mother by evacuating to higher ground soon after the earthquake struck off Japan's northeastern shore at 2:46 pm on the 11th of March. From a hilltop nearby they watched as their home and bakery shop were destroyed; the tsunami, as high as 46 feet in some places, swallowed much of the city of Rikuzentakata. The \$370,000 worth of business loans which Ichiro had taken on before the disaster remained, though, and he considered leaving the area to start afresh elsewhere.

Had he left, he would have been among many making similar choices; more than 1200 people had left the city to move elsewhere by the end of 2011 (Barta, Wakabayashi, and Fairclough 2011). But the baking business was started by his grandfather in 1926 who had specifically brought Ichiro's father into the family to keep the enterprise going. Even while sitting in temporary housing following their evacuation, his mother soon began telling reporters that she wanted to rebuild and begin making sweets for the community again. Pushed by her words, Sato found second hand baking gear and moved into a temporary location, discovering that many of his suppliers of equipment and foodstuffs refused to take his money when they found out where he was living. While distributing supplies at evacuation centers, he heard from many people discussing their nostalgia for the flavors of normal life: "People are longing for our local taste." Recognizing the draw of his community and the ways in which his sweets can help others rebuild their lives, Sato committed to rebuild whatever the costs (Wakabayashi 2011).

These two examples, drawn from the experiences of survivors of the compounded 3/11 events, show how critical social ties are during and after crisis. Individuals without ties to others may not be able to receive life-saving resources. In Mr. Tanaka's case, his decision to flee was motivated by his sister's urgent warning followed up by advice from trusted members of his neighborhood association. Then, when he and his wife sought to flee and were trapped inside a debris field in their car, they were only able to survive because of the efforts of a neighbor. In Mr. Sato's case, he had a number of alternatives to returning to his hometown of Rikuzentakata after the tsunami destroyed his family's business. Yet his mother's strong wish for the bakery to reopen and the fact that his social network provided the necessary equipment and capital kept him from exercising his right to exit the community. Over and over again across Tohoku, these kinds of connections altered the survival and recovery trajectories of residents.

For example, while dozens of villages in Tohoku were inundated by tsunami as high as 20 meters (60 feet), the mortality rates among the cities and towns varied tremendously. In a number of communities no one died, while in others as many as one-tenth of the population perished during the tsunami. Holding constant a number of factors, including wave height, sea wall height, demographics, income, population density, coastal exposure, and roads, the trust and social ties in the community proved critical in saving lives. Neighborhoods where people worked to check in on and save the lives of their neighbors had higher levels of bonding social capital and successful collective action to evacuate them from coastal areas. Those communities with lower crime rates (a measure of bridging social capital) before the disaster had, all else equal, a lower mortality rate (Aldrich and Sawada 2015).

Beyond serving as a critical resource during the disaster itself, bonding social ties also served as a shield against mental health problems in the years since the evacuation from the Fukushima nuclear power plant area. In a study which has regularly asked evacuees from the

town of Futaba about their mental health, wealth and health did not serve to mitigate very high levels of anxiety and concern. Those concerns regularly revolved around the ambiguous possibilities of return and livelihood success along with worries about health effects from exposure to radiation. However, evacuees with more social ties to known neighbors demonstrated stronger mental health, other factors held equal, than those with fewer such ties (Iwasaki, Sawada, and Aldrich 2016). All of these examples, drawn from the 3/11, show how bonding and bridging ties saved lives, reduced anxiety, and improved recovery.

Despite the critical role of social capital, there are a number of unexplored areas for urban resilience.

Gaps in the Literature

One of the first gaps in the literature on urban disasters involves a better understanding of the Interaction between social and physical infrastructure. We know that after Hurricane Katrina, for example, at least one neighborhood in New Orleans returned to rebuild their homes and restart their businesses even before critical infrastructure such as roads, gas lines, and electricity was ready (Aldrich 2012). In that case, social infrastructure helped rebuild physical infrastructure, as residents of the Mary Queen of Viet Nam (MQVN) area petitioned decision makers to invest in rebuilding electricity and gas service. These residents kept in touch during the evacuation, used Vietnamese language radio stations, letters, and visits to stay informed about activities, and returned to the community as a whole when most of the city had yet to do so. This case implies the primacy of social infrastructure. However, it may be that the rebuilding of damaged infrastructure will in turn spur the recreation or rebuilding of social ties in an area, as is happening in the city of Rikuzentakata in Tohoku, Japan which was devastated by the 11 March 2011 tsunami. There, a massive, several billion dollar project has raised the downtown close to 40 feet above sea wall, leveling nearby mountains to provide filler for the new shopping district which will be safe from once in a thousand year tsunami. Perhaps A variety of programs attempt to study the interaction between physical and social infrastructure.

The local NGO known as Ibasho ("My Space) in Massaki-cho, Japan has created an open physical space which has been used to deliberately create new friendships, a sense of efficacy, and deepen civic engagement, especially among the elderly and infirm (Aldrich and Kiyota 2017). Scholars have started to investigate the role of cafes, libraries, parks and other "third spaces" where residents can meet to exchange ideas, chat, and make friends. Overall we need more research on the differences in disaster outcomes between neighborhoods with more defensible and third spaces and those that are less committed to community focused planning.

Next, there are large gaps between the individual and community level studies of resilience. Psychology, psychiatry, and counseling continue to focus on the experiences and mental health of individuals exposed to trauma and crisis. Individual level characteristics - such as gender, family dynamics, socioeconomic status, and so forth - play a prominent role in understanding trauma and disaster outcomes for individuals. Social scientists, epidemiologists, and sociologists, in contrast, continue to focus on resilience and disaster recovery at the communal or neighborhood level. Neighborhoods may have a dense network of faith based organizations, schools, after school programs, third spaces, libraries, and so forth. Alternatively

there may be very little at the community level supporting residents who seek to build ties outside their homes. There have been few attempts to bridge the gaps between these two levels of analysis or create a unified framework of resilience.

A third gap in the literature is a widely available mapping system for capturing social capital across North America. While Susan Cutter and other experts have created a widely used vulnerability index (SoVI) which captures a variety of potential factors such as age, demographics, isolation, and so forth, this index does not engage social capital explicitly. A wider map social capital of the United States would provide residents and decision makers alike with information that would help guide resource investments before and after disasters. Such a social capital focused map would use both cognitive and behavioral measures to try to understand the engagement between residents, their neighbors, and decision makers.

A fourth and final set of gaps in the literature is on the connections between real world and virtual networks. Vast numbers of residents around the world engage in social media platforms such as Facebook, NextDoor, Instagram, and Twitter, using these apps during normal and crisis situations. We know little about the connections between higher levels of social capital in physical space and in virtual ones. It may be that those who are more connected to friends and family in everyday interactions, conversations over coffee, and phone calls are also more connected online. Alternatively many have feared that extended engagement in online communities comes at the neglect of real world relationships.

Challenges and future questions

These gaps suggest some potential topics for scholarly and public policy research agendas. First, scholars and NGOs alike should think deeply about ways to use mixed methods to measure interaction between physical and social infrastructure. By mixed methods I hope that scholars will use a variety of qualitative and quantitative tools including social network analysis (SNA), geographic information systems (GIS) data, regression analysis, participant observation, field studies, and interviews with relevant parties. In the medical field, randomized control trials (RCTs) serve as the gold standard for evaluating the effectiveness of medical interventions and treatments. So too we should think of ways to create conditions where we can effectively capture the impact of social networks on physical reconstruction after crisis and vice versa. To date, many studies have used case control or propensity score matching approaches (Aldrich and Kiyota 2017) but these are one of many approaches.

Next, psychologists and social scientists should work jointly to build a framework incorporating individual and community level factors that build urban resilience. Rather than remaining within academic silos and convenient boundaries, future studies should think clearly about factors such as coaches, mentors, institutions, and other community level factors that can affect resilience at the individual level. Children exposed to traumatic events as they grow older may be able to escape the poverty trap and the institutional blocks in the way of their success should they have mentors and coaches who can assist.

Third, researchers should engage social networks such as NextDoor, Facebook, and Twitter to measure the ways that virtual and physical communities interact. Initial studies of the social networks active after the August 2014 Napa Valley show that the most active online networks correlated strongly with the most active real world volunteerism and social networks.

Rather than demonstrating that virtual and real world communities float separately, they in fact seem to overlook very strongly. Future studies should look at online communities during crisis to understand their plasticity and also their measurable impact on residents.

Finally, scholars should work to create new nationwide, portable mapping system for social capital in the same way that social vulnerability has been mapped by Susan Cutter and her laboratory at the University of South Carolina. Given the high likelihood of disasters affecting communities across North America (and around the world), investing in systems that can better show levels of social capital will be invaluable in guiding resources where they need to go.

Given the power of disasters and the high likelihood of future catastrophes, social scientists and researchers should focus their attention on closing the gaps in the field.

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