The Evolution of Networks and the Resilience of Interorganizational Relationships after Disaster*

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Abstract

This study adopts a multi-theoretical approach to understanding organizational resilience following disaster. Theories of social capital, resource dependence, and evolutionary theory are employed as a framework through which organizational resilience is examined via the analysis of interorganizational networks (IOs) of disaster struck organizations (DSOs) following Hurricane Katrina. Approaching post-disaster organizational resilience using social network analysis highlights the way pre- disaster relationships and networking patterns play a vital role in post-disaster rebuilding. Indeed, data support the idea of structural inertia, suggest that the disaster is an event that further strengthened pre-existing relationships and structures of networks and was not a time when organizations might benefit from forging new relationships in seeking support and fueling survival. Implications suggest that the social capital accrued through longstanding partnerships and efficient pre-disaster networking through building communities of practice significantly impact post-disaster resilience.

The Evolution of Networks and the Resilience

of Interorganizational Relationships after Disaster

Catastrophic circumstances have laid the groundwork for extensive empirically driven theory development on individuals' (e.g., elderly, underprivileged) survival, for the efficacy of first responder networks, and the role of government for building resiliency (Kaniasty & Norris, 1993; Kreps, 1984; Murphy, 2007). However, organizational-level network activity of a community's local businesses and organizations and how their activities are impacted by and impact the broader community has had much less attention (recent exceptions include Doerfel, Lai, & Chewning, 2010; Runyan, 2006; Webb, Tierney, & Dahlhamer, 2002). In this paper, we assert that organization and business activities in a community offer an important dimension that has been overlooked while policymakers and researchers, albeit with justifiable reasons, focus instead on issues faced by local governments, first responders, and individual citizens' needs. Yet, organizations are the employers of the community, providers of goods and services, and their interactions and collaborations are a form of informal infrastructure that are an aspect of social resilience for a community (Fulk, Flanagin, Kalman, Monge, & Ryan,1996).

This paper adds to organizational literature on resilience and focuses on the dynamics of interorganizational relationships (IORs) that support recovering organizations. We consider the networked relationships to which disaster-struck organizations (DSOs) turned as the communicative structures that play into organizational resilience and thus survival. We depict change in these networks over recovery phases to extend the discussion of IORs and organizational evolution with the viewpoint of how relationships with supporting organizations (SOs) shaped a broader community network within which the DSOs survived, albeit at varying levels of resilience. We adopt a multi-theoretical model to understand the varying levels of resilience of organizations in terms of mechanisms that shape networks. From literature on *evolutionary theory*, we view the disaster event in terms of punctuated equilibrium and analyze the networks over sequential phases to assess structural inertia and resilience. Because of the role differential resource-holding capacities play in forming networks, which may be reflected in stability and change of IORs, we also use resource dependency theory to examine varying levels of resilience. Finally,

given the findings of Doerfel et al. (2010) that there are advantages of different organizations as network partners (e.g., professional associations) in disaster response, we use social capital to investigate stability and change of IORs. Taken together, then, we consider mechanisms of resilience by engaging a multi-theoretical framework using an evolutionary framework, resource dependency, and social capital.

This paper is part of a larger project examining how IORs impact organizational recovery, and how businesses reconnect and build new partnerships in order to rebuild after disaster. This paper thus builds on the findings from previous research from the same data set. The data used in the larger study capture phases of recovery, which allows for a focus on how organizations and their IORs evolve following disaster. Other papers report on a grounded theory model depicting stages of organizational recovery (Doerfel et al., 2010) and organizational resilience and technology use in practice (Chewning, Lai, & Doerfel, in press). Both of these studies used qualitative analyses; not social networks, and did not control for varying levels of resilience and resources.

This paper builds on the recovery stages framework previously published that reported a grounded theory analysis of this data set's in-depth interviews (Doerfel et al., 2010). We present the quantitative network data and report on aspects of specific types of networking that helped DSOs to recover, network patterns that distinguish levels of resilience post-disaster, and network structures across organizations with different types of resource holding capacity. We review the literature on evolutionary theory as it pertains to processes among organizations, resource dependency in terms of organizational resource holding capacity, and social capital to assess resilience in terms of interorganizational networks. We present a collection of cases that together contribute to network analyses of IORs at four recovery phases as New Orleans organizations rebuilt in the aftermath of Hurricane Katrina. The changes observed across the participating organizations' IOR patterns suggest organizing mechanisms for survival.

Multi-Theoretical Framework and Resilience

Studying disaster provides the opportunity to glimpse at the full lifecycle of social ordering, from the end of one type of order through the beginning and maintenance stages of another (Kreps, 1984). In crisis and disaster contexts, emphasis is on change, uncertainty, and high-stake outcomes.

Communication that takes place is altered by the very conditions that precipitate this condition, and disasters as crises force organizations to rely on both conventional and alternative forms of association (Kreps, 1984). Such contexts bring questions of survival to bear and highlight the tensions between micro- and macro-organizing processes. For example, one may consider particular strategies an organization adopts as being fundamental to survival and/or the particular ways environmental factors may shape or impede rebuilding. Thus, examining these tensions in terms of resilience can be best accomplished by drawing on theories of organizational and environmental action.

Network tensions of stability versus change. Resilience is a line of inquiry that studies organizational traits and processes in order to determine factors related to organizational survival. Resilience has been defined in terms of an organization's redundancy, capacity for resourcefulness, effective communication, and capacity for self-organization in the face of extreme demands (Kendra & Wachtendorf, 2003). Recent studies applied the concept of resilience to examine disaster response. For example, Mark, Al-Ani and Semaan (2009) looked at disaster recovery in wartime Iraq and identified several properties of resilience, including *reconfiguring social networks*, *self-organization*, *redundancy*, *proactive practices*, and *repairing trust in information*. Turning towards more process-oriented resilience, part of Powley's (2009) discoveries included resilient organizations' ability to mobilize social capital and networks. Affected organizations might look outside the realm of expected organized relationships to other types of emergent relationships. Because of this complexity, it is valuable to study such events not only in terms of "commonsense categories" such as firms, government units, and voluntary agencies, but also in terms of "populations of social units that engage in similar domains and/or initiate, maintain, and suspend similar forms of association" (Kreps, 1984, p. 316). Kreps' suggestion for such research directions evokes organizational theories about survival and evolution.

Darwin's (1936) evolutionary theory has been adapted as a way to understand the communicative processes, organizational traits, and the impact of environmental events that relate to organizational survival over time (Hannan & Freeman, 1977; Monge, Heiss, & Margolin, 2008; Poole & Van de Ven, 2004). Evolutionary theory goes beyond a particular organization's resilience traits, with communication-

focused theorizing which broadens the scope regarding the role of IORs in the survival of organizations and extended community of organizations (Monge et al., 2008). Broadly speaking, organizations repeat cycles of variation, selection, and retention (VSR) through which they coordinate, compete, and survive. Hannan and Freeman (1977) laid the groundwork for a focus on selection through competition, but scholars concerned with how organizations negotiate through VSR cycles also consider tensions between environmental influences and local control, across populations. One direction such inquiries have gone is in identifying populations of organizations that emerge as ideally suited for survival (Astley, 1985). Analyses consider structural inertia (Aldrich, 1999; Aldrich & Ruef, 2006; Hannan & Freeman, 1984; Shumate, Fulk, & Monge, 2005), strategic management (Keck & Tushman, 1993; Romanelli & Tushman, 1985), and organizational traits (McKelvey, 1982; McKelvey & Aldrich, 1983) as possible mechanisms of survival. More recently, communication-centered views of evolution hone in on link fitness (the ability of the link to sustain itself) and network carrying capacity (the most links a network can sustain) as organizing mechanisms of survival (Bryant & Monge, 2008; Monge et al., 2008). Across these studies, the evolutionary perspective is about the dynamic nature of communication networks and the patterns of change through phases of organizations' existence (Monge et al., 2008; Poole & Van de Ven, 2004).

Some empirical studies in communication offer evidence supporting structural inertia or the idea that established networks are difficult to change (Hannan & Freeman, 1984). Network dynamics can be driven by past alliances, geographical proximity, and common shared relationships (Doerfel & Taylor, 2004; Flanagin, Monge, & Fulk, 2001; Shumate et al., 2005). So, although networks may be dynamic, fit links may stand the test of time and become a stabilizing network force. Regardless of the formation and maintenance of an organization's relationships, networks can be seen as the process of the VSR mechanisms being carried out (Monge et al., 2008). That is, an organization initiates communication to explore opportunities for obtaining resources (e.g., advice). This experimenting process may then be followed by the development of selection preferences over certain communication partners. Over time, these communicative practices and partners can become routine in an organization's operation. The routines that emerge may reflect the notion of structural inertia. Some scholars that consider structural

inertia assess the impacts of environmental jolts and offer reasons why reliable, established links might prevail. Related, Hannan and Freeman (1977) argued that in the context of major environmental threats, organizations do not make radical changes. Adjusting aspects of organizing would seem distracting during an attempt to survive under threat. And in routine times, structural inertia refers to the power of preexisting relationships such that they drive organizational stability. Preexisting relationships become reified in the organization's practices and thus the emergent inertia makes fundamental change difficult.

But in the New Orleans context, the population was nearly half of the city's pre-Katrina levels (http://www.cnn.com/2006/US/05/02/hurricane.plan/index.html), creating an environment that would necessitate change. The impact of the 2005 hurricane season can be likened to the environmental jolt that previously studied technological advances have had on the evolution of organizational forms. For example, Astley (1985) explained such moments in the context of technological innovation as "discrete origins and extinctions…. [that] 'punctuate' extended periods of negligible change or 'equilibrium'" (p. 230). In terms of VSR, disaster was a unique jolt because organizations were forced to change their network structures in response to rapid and unpredictable depletion of resources and IORs in the environment, at least in the time immediately following the event. That is, the disaster disrupted equilibrium so post-disaster networking could be viewed as a time during which organizations cycled through evolutionary process again, starting with variation, or the experimenting time, to test out new links. Indeed, organizations may try to stick to their routines, but they may also experience new variations, or both, patterns reflective of simultaneous (Aldrich, 1979) and iterative (Freeman, 1981) VSR processes. This thinking draws on Schumpeter's (1934) description about the ways an innovation jolts a stable state and kicks the variation of a species back into trials that evolve into selection and retention.

This punctuated equilibrium orientation departs from the incremental, gradual change and instead focuses on distinct episodes of perturbance (Gersick, 1991; Lewin, Weigelt, & Emery, 2004; Tushman & Romanelli, 1985). Punctuated equilibrium considers internal organizational processes (Gersick, 1991) but more broadly considers the ways in which organizations break out of inert (static) states (e.g., Hannan & Freeman, 1984). At the interorganizational level, when a jolt like a disaster hits, the network to which an

organization is connected is also impacted. So, the disaster context presents a survival tension that is not adequately addressed by evolutionary or ecological theorists. On one hand, scholars like Hannan and Freeman (1977) note that turbulent times are when tried and true relations are vital (structural inertia). On the other hand, if the jolt impacts the whole interorganizational community such that each organization is struggling, are those former partnerships sustainable? Do IORs predating an environmental jolt across an entire community survive or is it a time when new relationships are tried (or sought) out? Considering the unique jolt the hurricane season presented, we consider these tensions and thus ask:

RQ1: What are the dynamics of post-disaster IOR networks in terms of stability (structural inertia) and change (punctuated equilibrium)?

Resource dependency and evolution. The stories analyzed in Doerfel et al. (2010) focused on the mobilizing of social capital to acquire networks and the resources in them, but did not consider the extent to which participating organizations ranged in terms of resource holding capacity. Resource dependency (Pfeffer & Salancik, 1978) has established that organizations' networking (and thus the broader structure of the IOR network) is driven in part by resource control. While some of the focus from an evolutionary perspective weighs heavily on the organization's broader relationship with its environment, resource dependency turns to the firms themselves in terms of resources and structuring relationships with external partners/ the broader environment (Oliver, 1991; Pfeffer & Salancik, 1978). Empirical studies have confirmed that relationships can be structured to improve access to financial resources (Simmons, 2012; Stearns & Mizruchi, 1993) and reducing uncertainty (Johnson, Daily, & Ellstrand, 1996; Lang & Lockhart, 1990). Other work has shown resources and access to resources as mechanisms that contribute to network position. These resource wielders evolve as more central and influential in their IORs (Doerfel & Taylor, 2004; Galaskiewicz, 1979; Mizruchi, 1993).

Romanelli and Tushman (1986) note that studies that consider resource dependency underscore "the value of classifying firms according to basic differences of product or service and differences in relationship to environments" (p. 614). In other words, some organizations are insulated from unplanned events (e.g., large corporations have the resource capacity to retain payroll) whereas others might be more

vulnerable (e.g., a local coffee shop needs the week's receipts to make payroll). At early recovery stages in New Orleans, resources across the city were scarce (Doerfel et al., 2010; Runyan, 2006). In post-Katrina New Orleans, organizations that did return had varying levels of success (Doerfel et al., 2010) and the resources fundamental to organizations' functioning (workforce, physical supplies, communications infrastructure) were dramatically depleted. Organizations were displaced from their established routines yet many were passionate about returning to their home (Doerfel et al., 2010). Indeed, some returned immediately despite little-to-no basic infrastructure such as electricity. We thus consider whether and how resource-insulated and resource-vulnerable organizations exhibited different networking patterns across phases of disaster recovery:

RQ2: How do the network profiles of resource-insulated and resource-vulnerable organizations vary in different phases of disaster recovery?

Resilience and social capital. Networked forms of organizing support flexibility through partnering with varying others to share resources and transfer information. Network structure has implications not only for the organization of relationships among network members, but also for the types of information passed among these members. Social capital refers to the resources embedded and available in social relationships that are accessed and/or mobilized by actors in purposive actions (Lin, 1999, p. 35). Social capital is embodied in relationships, and represents resources that social contacts and structures of contacts afford in a network (Doerfel et al., 2010). Social capital taps into the idea of network structure by examining the information and resources shared by bonding (cohesive, dense) and bridging (diverse, outreaching) networks. Having a balance of bonding and bridging ties may be theoretically ideal in terms of efficiency and effectiveness (Burt, 1992, 2000), however, practicalities such as time and resources dedicated to building robust networks may be difficult after a system-wide interruption. On one hand, social capital theory is about building dense networks for organizational support and gleaning trustworthy information. On the other hand, innovation and creativity are driven by diversity in one's networks. Powell, White, Koput, and Owen-Smith (2005) showed important advantages

in the evolution of the life sciences field of having diverse ties to more broadly linked partners or with others whose ties are well linked.

Dense networks are made up of members who are highly familiar, often similar, and have a long history of repeated interaction, so dense networks are viewed as cohesive and closed (Ahuja, 2000). Similarly, networks based on homophily can provide quick access to commonly used resources. In fact, Hulbert, Haines, and Beggs (2000) found that homophilous relationships are beneficial in times of structural turbulence and become more important during crises. Such networks also facilitate trust and cooperative exchange, which in turn provide clear norms that lead to easy exchange and high cooperation. This may not lead to greater innovation, but it can influence decision-making power and an environment of trust in which members are more willing to take risks. In Doerfel et al. (2010), social capital was central to organizational survival after disaster, however quantitative variation over phases was not assessed. Moreover, Doerfel et al. emphasized 'what worked" with broad brushstrokes and did not control for varying degrees of success in the organizations' return experiences. Broadly speaking, the underlying implication is that organizations with more social capital in terms of dense social networks are more resilient because they reap benefits having to do with information and resource access.

In terms of creativity and survival, however, more *diverse* networks have their advantages (Powell et al., 2005). Post-disaster, information flows could include details about how to get back into the area before evacuation orders are officially lifted, the quickest way to access new cash flow, or simply where to get clean water and fresh produce. Diverse networks could facilitate acquiring such information in addition to offering ideas for solving the unique challenges created by the unprecedented circumstances. That is, dense networks (bonding social capital) may be more advantageous because of the need for trustworthy information, but diverse networks (bridging social capital) could be more critical for finding creative solutions to the very unique situation and scope of problems created by the disaster. Other research points to bridging social capital (diversity) facilitating member access to resources and coordinating action (Garguilo & Benassi, 2000; Podolny & Baron, 1997). For example, network diversity has been shown to affect the degree to which information and resources can be beneficially obtained and

leveraged by network members (Gargiulo & Benassi, 2000; Hulbert et al., 2000; Podolny & Baron, 1997). There are thus different views on what type of network provides the most benefit.

Moreover, norms and reciprocity based on obligation may actually hinder access to information and resources. This point of view asserts that advantage lies in having an open network structure in which members are connected to many actors who do not share connections with each other (Ahuja, 2000; Podolny & Baron, 1997; Powell et al., 2005). These relatively unconnected actors often span several networks but are not deeply embedded in any given network, thus having access to unique resources without pressures like loyalty or conformity. Such networks are often associated with greater flexibility and innovation, because they tend to contain more diverse members with less overlap of resources. Additionally, networks that are more open in structure contain less "amplified reciprocity," or tendency for members to act against their own benefit out of a sense of obligation for past interactions, which in turn frees members to act in a way that promotes the current situation (Gargiulo & Benassi, 2000). Related evidence also suggests that organizations have preferences for diversity (Powell et al., 2005).

In a disaster situation similar organizations may suffer the same shortage of supplies while dissimilar ones may have more to offer when groups come together in an attempt to problem solve or attain goals that require diverse resources. Whether or not organizations form open or closed networks can have implications for how successful they are in reestablishing themselves post-disaster. In short, bonding and bridging forms of social capital suggest advantages but understanding their relative advantages in the context of disaster and organizational resilience remains unclear. We thus ask:

RQ3: How do types of social capital relate to organizational resilience?

As Hannan and Freeman (1984) argue, "the most important issues about the applicability of evolutionary-ecological theories to organizations concern the *timing* of changes" (p. 151, emphasis retained). Given an evolutionary framework and our interest in disaster recovery for organizations embedded in cross-population communities, this paper considers the interplay between organizations and their communities vis-à-vis IORs and hones in timing by arguing that the disaster is an environmental jolt that punctuates the system's equilibrium. Post-disaster NOLA, then, provides a quasi-experimental

context to understand the survival processes and the role of communication networks over the course of a VSR cycle. As Astley (1985) argues, cross population convergence also happens and organizations become fused together into "functionally integrated systems, or organizational communities. Only those populations able to function as constituent members of such communities survive" (p. 225). Community survival may be reflective of selected variation of IORs. We thus shape this paper around the general questions that consider IORs and networked structures that may be organizing mechanisms in resilience and thus survival. In the post-Katrina New Orleans disaster context, we present two-mode network data from a study of a variety of organizational populations and how those particular organizations engaged other organizations across their community as they moved through stages of disaster recovery and rebuilding. The next sections review the collection of cases and the way two-mode networks were used and analyzed to answer our research questions. We then discuss our findings and their implications.

Methods

Hurricane Katrina caused such large-scale destruction that over a year later, limited return had occurred on the part of New Orleans citizens and organizations with the population at about 60% (Nossiter, 2006). In the immediate aftermath, public services (e.g., electric, phone, water) were wiped out or were very limited in availability. Service availability spread to many areas by around December 2005, however, in other areas, like the 9th ward district, a lack of services still left perilous living conditions. Physical destruction left roads impassable and open areas covered with wreckage and/or water, thick mud and sediment, fallen trees, and houses, building parts, and vehicles that flood waters left strewn about. In December 2005, traffic lights at many intersections remained dysfunctional and traffic flow was instead managed by temporary stop signs placed on wood construction horses. Neutral grounds (the green space that divides a boulevard) were used to pile debris and other areas that were deemed "higher" included parking lots where owners left vehicles assuming their cars would be stored safely above flood lines. These vehicles were abandoned, having been destroyed by the muddy brackish waters that flooded them. A tour in March 2006 (8 months later) of areas in which many participating businesses and organizations were located indicated that debris piles and abandoned vehicles were removed. City visits became less

about seeing the storm's wreckage even though blue-tarped roofs and ongoing construction remained a presence throughout the course of the field visits. In this context field research and interviews took place.

Participants and Convenience Sampling

The subject of interest was organizations across populations. Informants were those in charge and making or privy to critical decisions (e.g., owners, CEOs, presidents). In-depth, semi-structured interviews were conducted. Interviews were conducted with 64 different organizational and business leaders from December 5, 2005 until August 2007 and ranged from 12 to 105 minutes (m = 52.42 minutes, SD = 17.28). Whereas the sample was biased towards those who returned and began rebuilding, the method complemented the central concerns about the evolutionary framework and resilience. Initial contact was made with a professional business networking club located in New Orleans. The first author recruited business owners and organizational leaders who participated at the organization's first official meeting held after Katrina. Subsequent field visits (n = 11) enabled the first author to recruit when attending various public events such as at the Bring Back New Orleans Commission meetings and when visiting shops, restaurants, and businesses. An additional five field visits for completing interviews were made by other research team members, including two professors and three graduate students.

Interviews were with a variety of organizational types with varying degrees of destruction to their communication and physical infrastructures. Financial data were not available in most cases. Interviews included problems that are considered structural aspects that can impact the selection of communication partners. Specifically, participants discussed the status of employees and communicating with them via information and communication technologies (ICTs) and the extent to which physical damage to working space impacted business. Organizations in this study include (a) fewer than 10 employees, including the owner (n=22); (b) small entities consisting of 11-20 employees (n=11); (c) medium sized entities consisting of 21-100 employees (n=17); and (d) large entities having greater than 100 employees (n=6). Most organizations required physical space or to be present in New Orleans to operate (n=33), could (at least temporarily) operate with some mix of face-to-face and virtual work but at some point needed to be local to operate (n=21), or could fully operate virtually (n=2). The amount of physical damage sustained

to properties ranged from extensive (e.g., parts of roof off, uninhabitable space, numerous broken windows, flooding inside; n =18) to minimal (e.g., usable space but some damage like a broken window or lack of electricity; n=36; no including two virtual organizations).

Interviews

This study uses 52 first-round[i] interviews conducted between December 2005 and April 2007.[ii] More than half of the first-round (Time 1) interviews were conducted in the first eight months following the storm (n = 33). We collected another five first-round interviews in August 2006, two in November 2006, and one in January 2007. An additional 15 Time-1 interviews were gathered in March and April of 2007. Although conducted at different times between 2005 and 2007, all interviews followed the same basic interview protocol and directed participants to address former relationships, what they actually did in the immediate aftermath of the storm as well as when they returned to New Orleans. While later interviews sometimes included more detail about later stages of recovery, each of the interviews covered the same basic topics as guided by the interview guide.[iii] Although the interview guide was used to ensure consistency across interviews, participants generally addressed the interview topics with minimal prompting by the interviewer. The protocol included questions that asked participants to characterize their interorganizational networks before, while displaced, immediately upon return, and once their activities were again routine. Participants discussed information gathering and connecting with old and new partners following the hurricane, use of ICTs, lessons learned, and what helped and hindered them in their efforts to return to business. Questions were open ended, and participants were also asked to include any information that they thought were important to their personal stories. Stories provided robust accounts of relationship management and communication challenges. As reported in Doerfel et al. (2010), the sequence of events were easy for participants to recall, and because the event was highly salient (Norris & Kaniasty,1992; Pearson, Ross, & Dawes, 1992) they offered distinct details that allowed for phases of before, during, and immediately after the storm, as well as once settled into a routine, to emerge. The amount of time spent in post-storm phases ranged, but there were particular qualities about the interviews

that allowed for demarcating phases. We elaborate on how coders identified phases of recovery in the below section about *over-time phases*.

Procedures for Coding Interviews

Over 1,500 pages of interviews were assessed over a two-year period by a team of seven people. While the first author was involved in all steps of the data collection and analysis process, other members of the research team participated in varying degrees. Some members participated in early stages of code creation and other members then refined and applied the codes to interview transcripts. Coders who were not interviewers were active in creating the coding scheme and their "once-removed" relationship with the data helped balance out the interviewers' potential biases and vise-versa. Coders who were involved in the earlier part of the coding process were not involved in the creation of this paper, thus alleviating the potential for the creation of codes biased towards the subject of this paper. Alternating team members in this way allowed for fresh perspective and objectivity in data analysis. However, keeping a core group of team members for the entire process ensured that research goals, as well as an understanding of both the corpus and the context in which interviews took place, would remain a central focus of the analysis.

A constant comparative technique (Boeije, 2002; Miles & Huberman, 1994; Strauss & Corbin, 1998) was used to inductively create codes data using the ATLAS.ti computer program. Initially, coders independently evaluated a set of transcripts, then, with a coding partner, compared their emergent themes and discussed their differences and similarities. Coding teams then met together to discuss all emergent themes across initially coded interviews. Over the course of several meetings, the team developed a coding scheme. Next, three different interviews per pair of coders were analyzed then the entire team met again to review the coding, any newly emergent themes, and issues raised in applying the codes created from the initial ones. After revising codes, an additional two interviews were coded independently, with coders meeting to compare results, resolve differences, and finalize the codebook. At this stage, each pair of coders reported consistent agreement about episodes that needed to be coded and agreed that a highly reliable and valid coding scheme was achieved.[iv] All transcripts were then coded using ATLAS.ti. Each transcript was coded by two coders but to avoid intra-team biases, coding partners varied. For example,

coders A and B coded interviews 1-5, B and C coded interviews 6-10, and so on. This round robin approach to partnering coders provided assurances that team biases would not emerge, reduced error in applying codes, and ensured consistency across teams coding partners rotated. ATLAS.ti then allows the analysts to search the entire corpus for those sentences and paragraphs of quotes that have been coded with the general categories, including identifying each mention of a named communication partner or organizational relationship (i.e., a contact to whom the organization is connected in their network).

To capture all salient contacts named by organizational leaders, ATLAS.ti queries were used to search for discussions about sources of support in terms of emotional, informational, and financial support and that such a contact's support was for professional reasons and was deemed useful. To capture the longitudinality of the link, ATLAS.ti queries were made for codes representing timing of contact (before the storm, while evacuated, immediately after, and link connected after settled in). Any time a contact was named in the corpus, that unique contact (an organization, the organization of the individual named when the individual represented the organization, or an individual) was named and the codes on Table 1 were used to categorize the contacts, or alters, so that comparison across cases could be made.

Study Variables

Resource holding capacity. Organizations were dichotomously categorized based on resource holding capacity in terms of their ability to hold and obtain resources and is a pre-disaster condition: resource-vulnerable and resource-insulated organizations. *Resource-vulnerable* organizations were those organizations that have to acquire their primary financial resources through charitable contributions and grants or are particularly reliant on a physically present customer base. Thus, nonprofits and retail/ restaurant businesses were categorized as resource vulnerable (n = 31). Those deemed *resource-insulated* (n=21) disseminate financial resources, hold specialized information and do not require a physical co-presence with clients to operate, or are a branch of a large, multinational, for-profit institution. Knowledge work firms, large businesses, foundations and the first responder were categorized as resource-insulated. *Resource holding capacity* was used to answer RQ2 and further examine RQ 1.

Resilience. Participating organizations were coded into mutually exclusive groups based on comments made throughout their interview that reflected their own organization's successes and their outlook about the general future for both their specific organization and New Orleans, in general. Particular observations were shaped by aspects of resilience including capacity for resourcefulness, effective communication, and the capacity for self-organization in the face of extreme demands (Kendra & Wachtendorf, 2003). Using the ATLAS.ti query tool, text searches for the code "perception of return" provided summaries of all relevant quotes. Then, pairs of coders evaluated this evidence independently and coded the organization for *resilience* in terms of *low* versus *high resilience*. The coders had complete agreement. *Resilience* varies dichotomously with low- resilience (n = 16) versus high- resilience organizations (n = 36)[v] and was used to answer RQ3 and further explore RQs 1 and 2.

Over time phases. Four phases included (a) *pre-disaster*- those IORs discussed in the context of doing business prior to the storm; (b) *displaced*- the time when the organizational leader was displaced; (c) *post-ASAP*- the time depicted by activities conducted immediately upon return and before routine was established; and (d) *post-settled*- the time when the leader reported being back to a routine in terms of business functioning. While these phases are chronological, they are not defined by a fixed time such as days or weeks. Each organization passed through these phases, but at varying times. Each phase has a corresponding two-mode network for answering the RQs and testing the hypotheses. As part of the interview protocol, when the timing of connecting with a tie was not made apparent by the participants, they were probed about the timing and nature of the connections they reported making with other organizations, as noted in the above section heading *Interviews*. Coders were thus able to easily identify ties made before the storm (phase-1, or *Pre-Katrina*), ties made during the participating organization's evacuation of New Orleans (phase-2, or *Displaced*), ties made as soon as possible and/or immediately upon the participating organization's return (Phase-3, or *Post-ASAP*), and ties made or retained after they had settled into a routine of post-disaster "normalcy" (Phase-4, *Post-Settled*). That phases were more readily memorable and meaningful to the participants than particular dates or length of time meant coders qualitatively identified phases. These are thus sequential phases; not chronological time-stamps.

Two-Mode Network Analysis

Although all of the participant organizations could be viewed as one large system- New Orleans- very few organizations identified other participants as part of their system, thus indicating the presence of numerous subsystems within the broader community. We therefore treat the data as two-mode networks, where each participant's contacts were coded for particular categories of organizations (Table 1). In this way, the second mode represents the collection of *organizational types* with whom networking takes place. Two-mode network data have been used for decades (e.g., Davis, Gardner, & Gardner, 1941) and enable the researcher to assess dyadic relationships and general social structural qualities as a function of shared connections to alters, or contacts, by the interviewees (see Borgatti & Everett, 1997). Normally, two-mode network data concern themselves with actors (egos) and events (alters) to which actors attend. In this case, instead of events, the alters are those entities (e.g., organizations, businesses, types of individuals) to whom organizations turned. We consider this an organization-level way to depict density and diversity, in line with the way diversity was measured by Hampton, Lee, and Her (2011), who argue that for individuals surveyed, their network ties' occupation is a way to assess diversity. "Occupations vary in prestige, and people in high prestige occupations tend to have special resources tied to income, education, and authority" (Hampton et al., 2011, p. 1037). Similarly, identifying types of organizations to which participants connect, diversity can be analogously assessed. Much like the procedures used by Hampton et al., when a participant *i* named another organization *j* as a contact (even if also a study participant), organization *j* was categorized for organization type for the second mode. The more variety of types an organizational participant named, the greater the organization's network diversity.

Two-mode network derivations. The section on interview coding describes how contacts were gleaned from interviews. Each participating organization (n = 52) was assigned its own row, which was populated by the number of times they named a particular organizational over the four phases. The total number of links identified by all participants was 923. If a specific organization was named more than once it was counted only once in a phase; if different organizations were named that were categorized as the same organizational type (Table 1) they were each counted. If an organization type listed in Table 1

was not mentioned, the corresponding column was assigned a zero. Organizations discussed in a negative light (e.g., ineffective) or identified but not reachable were included in the coding but a value of zero was assigned. Then, each row's cells for each of the four phases were divided by the total number of contacts named by ego, across all phases. A resulting two-mode (*n x m)* matrix represented the organization and business leaders' (*n = 52)* reported contact ties (*m* = 49*)*. Thus, matrices are valued and rectangular and represent the extent to which ego, *n*, named contact types, *m*, as links used (or not) over four phases. Four *n* x *m* networks (one for each point in time) were constructed. These matrices were then used to extract sub-matrices based on the variables *resource holding capacity* and *resilience*. In other words, *n* x *m* matrices representing (1) resource holding capacity-insulated; (2) resource holding capacity-vulnerable; (3) high resilience; and (4) low resilience were extracted from the *n x m* networks from the four phases. Two-mode matrices were also used to compute density and diversity (see below).

Affiliations matrix construction and IOR community networks. To answer RQ1, relationships among the *contacts* named by organizations, that is, the network profiles of the organizations, were assessed using the Quadratic Assignment Procedure (QAP) as well as Multiple-Regression for matrices (MR-QAP), which requires square matrices. In other words, the two-mode network can be transformed to reveal relationships among the contacts named as a function of those organizations who named them. Square matrices were created in UCINET-6 (Borgatti, Everett, & Freeman, 2002) using the *Affiliations* option to convert the original *n* x *m* matrix into an *m* x *m* matrix for each phase. The minimum method was used because the data are valued and thus the resulting cell sizes do not increase exponentially the way taking a cross-products approach would (Borgatti et al., 2002). The resulting square matrices, *m* x $m_{1\text{-}4}$, (subscripts represent each phase) are a relational representation of named contacts (SOs) in the post-disaster IOR systems and are how the *IOR networks* are represented. QAP, a way to compute correlation between pairs of cells in two matrices, and MR-QAP, a way to compute regression on network matrices, were both conducted in UCINET-6. Both QAP and MR-QAP take into consideration the fact that network matrices are not independent (see Dekker, Krackhardt, & Snijders, 2007; Krackhardt & Porter, 1986).

Centrality. To answer RQs 2-3, centrality analysis was used to assess all of the contacts named (Table 1) in general, and to assess the contacts named specifically for the resource-insulated and resource-vulnerable subnetworks, and the low- and high-resilience subnetworks. Degree centrality (Freeman, 1979) is a measure of how many other members of the network a given member is directly connected to. In this study, those SOs that are reported most frequently, and therefore have high degree centrality, are seen by the collective as important because they represent the most relied upon organizations in a network. Degree centrality was computed by taking the mean of the column totals on the *n* x *m* matrices for each phase. Thus, those organizations that were named as links by the multiple organizations and those with stronger values emerge as more central.

Density. Density is a way of assessing the relative activity of a network and was calculated for each of the *resilience m* x m networks using the compare densities option in UCINET-6. Density is based on the total number of ties and accounts for multiple ties to the same organizational types. The way the original *n* x *m* matrices were constructed (see above details), densities are normalized, thus enabling comparisons across matrices.

Diversity. Diversity was assessed by analyzing the *n* x *m* matrices' most central members and the extent to which contacts are within the same population as ego's (the participating organization) or are part of the more general community. The list of organizations on Table 1 includes details about how some contacts are, by virtue of their definition, within an organizations' population or not.

Stability. The RQs consider the relative network stability of resource-insulated versus vulnerable organizations (RQ1) and low versus high resilience organizations (RQ3), which can be inferred by analyzing the corresponding *m* x *m* networks' QAP correlations over phases and by assessing the SO's centrality rankings and the extent to which particular SOs' centrality rankings change over time.

Results

RQ1 asked about the dynamics of post-disaster IOR networks in terms of stability (structural inertia) and change (punctuated equilibrium). To examine how the IOR community changes and evolves over phases of disaster, MR-QAP analysis was computed (see Table 2 for results) on the extent to which

the first three over-time phases predicted the post-settled contact networks in general, as well as specifically for sub-networks constructed for the variables *resilience* and *resource holding capacity.* Results show consistently, across resilience, resource holding capacity, and for the whole networks, the strongest predictor of post-settled contact networks were the pre-Katrina networks (β =.72, p=.000), and this was strongest for high-resilience and resource-insulated networks (β =0.73, p=.000; β =.75, p=.000). The adjusted R^2 values were lowest for the low-resilience and resource-vulnerable contact networks but the trends remain consistent: over time, organizations -- regardless of their relative resilience or the extent to which they are deemed resource-insulated-- returned to their former relationships in the aftermath of the disaster. One notable variation, however, was that for low-resilience organizations, the displaced phase was not a time when networking activities even weakly predicted subsequent networks.

Centrality analysis of the *n* x *m* networks over four phases is reported in Table 3. The results of the rank order analysis showed that the ranks of the key SOs were significantly different over phases ($\chi^2(3)=28.571$, p=.000). *Post-hoc* analysis with Wilcoxon Signed-Rank showed that there were significant differences between phase 1 and phase 2 (Z = -4.146, p = .000), between phase 2 and phase 3 (Z = -3.218, p = .001), and between phase 3 and phase 4 (Z = -3.003, p = .003). There was no significant difference between phase 1 and phase 4 (Z = -.986, p = .324). Based on the top ranked organizational types identified by boldfaced font in Table 3, the types of entities to whom organizations turned after the storm included professional associations, businesses (different type than the focal organization), clients, suppliers, and businesses (same type). One notable shift was the media (prof) contact, which moved into the top 10 at the last phase, reflecting organizations' need to mass-communicate/advertise.

RQ2 asked how the network profiles of resource-insulated and -vulnerable organizations varied in different phases of disaster recovery. QAP correlations show moderate, then weak, but significant correlations between groups over time. Compared with resource-vulnerable organizations' correlations of pre-disaster networks with post-disaster phases (r_{during} = .46, r_{ASAP} =.68, $r_{Settled}$ =.81; all p=.00), resource-insulated organizations tended to have network profiles that consistently correlated with their pre-disaster networks over time (i.e., high correlations, where r_{during}=.71, r_{ASAP}=.72, $r_{settled}$= .91; all p=.00). That is,

resource-vulnerable organizations' networks were not as strongly correlated with their pre-disaster networks as their resource-insulated counterparts despite the fact that none of the differences were statistically significant (Z_{during} =1.291, p=.197; Z_{ASAP}=0.26, p=.795; $Z_{Settled}$=1.326, p=.185).

To further explore the network profiles of resource-insulated versus resource-vulnerable organizations over phases, analyses of most central SOs across four phases (e.g., Resource-vulnerable$_{pre\text{-}disaster}$, Resource-vulnerable$_{during}$, Resource-vulnerable$_{ASAP}$, Resource-vulnerable$_{settled}$ 4) are reported in Table 4. For each contact type, the number in the parenthesis corresponds with the rank of the centrality as reported by the ego organization at each phase. For example, professional associations were ranked first as the most popular organizational type reported by resource-vulnerable organizations in the first phase (pre-disaster). In each phase, the top 10 supporting organizational types are bold-faced. Analysis showed that there were significant differences of the ranks of the SOs over time for resource-insulated organizations ($\chi^2(3) = 20.151$, $p = .00$). *Post-hoc* analysis with Wilcoxon Signed-Rank Tests was conducted with a Bonferroni correction applied, resulting in a significance level set at $p < .008$. There were significant differences between pre-disaster and displaced phases (Z=-3.281, $p = .001$), between displaced and settled phases (Z = -3.224, $p = .001$), and between ASAP and settled phases (Z = -2.763, $p = .006$). Similarly, for resource-vulnerable organizations, the ranks of the SOs were significantly different over phases ($\chi^2(3) = 19.214$, $p = .00$). Yet *post-hoc* analysis with Wilcoxon Signed-Rank revealed significant differences between pre-disaster and displaced phases (Z = -4.114, $p = .001$), displaced and ASAP phases (Z = -3.889, $p = .00$), and displaced and settled phases (Z = -3.567, $p = .00$).

Taken together, the resource-insulated organizations had more stable network profiles following the disaster, but some change occurred when they resumed routine functioning. In contrast, resource-vulnerable organizations experienced change of network profiles when the disaster first struck, but no further change was seen when they tried to return to routines. Furthermore, based on the top ranked organizational types identified with the bold-faced font in Table 4, the resource-insulated organizations' network profiles included contact with the business (same type as the focal organization) contacts over time, suggesting the maintenance of a community of practice. Other organizations included in resource-

vulnerable organizations' network profiles suggest these "vulnerable" organizations were reaching out with limited success to a variety of potential others (e.g., city government, media for information). Moreover, the types of alters also indicates rebuilding challenges (e.g., contractors for professional reasons) and mass communication challenges (media- professional), which meant the organization received media coverage or the organization turned to media outlets to publish mass communications.

In answering RQ3, which asked about types of social capital as they may relate to resilience, QAP correlations were conducted between low- versus high- resilience organizations' networks at each phase. Compared with low-resilience organizations (with correlations of .55, .64, .80), high- resilience organizations have stable network profiles (i.e., high correlations: .68, .72, .89) despite the fact that none of the differences in correlations were statistically significant (Z=0.644, p=.519; Z=0.456, p=.648; Z =0.987, p=. 323). Analysis of the most central contacts for high- and low- resilience organizations across four phases is reported in Table 5. There were significant differences of the ranks of the SOs at different phases for high- resilience organizations ($\chi^2(3) = 23.694$, $p = .000$). *Post-hoc* analysis with Wilcoxon Signed-Rank showed that there were significant differences between phase 1 and phase 2 (Z = -3.385, p = .001), between phase 2 and phase 4 (Z = -3.379, p = .001), and between phase 3 and phase 4 (Z = -2.953, p = .003). Similarly, for low-resilience organizations, the ranks of the SOs were significantly different at different phases ($\chi^2(3) = 27.692$, $p = .000$). *Post-hoc* analysis showed that there were significant differences between phase 1 and phase 2 (Z = -4.431, p = .000), between phase 1 and phase 3 (Z = -3.056, p = .002), between phase 2 and phase 3 (Z = -3.413, p = .001), and between phase 2 and phase 4 (Z = -3.653, p = .000). In sum, these results suggest that, compared with high- resilience organizations, low-resilience organizations experienced more change of networks when the disaster first struck, but no further change was seen when they tried to return to routines.

In terms of different network structures, as evidenced by density values reported on Table 6, at each phase, SO network densities were significantly greater for high-resilience organizations. According to Table 5 the low-resilience organizations across all phases have the same top-4 contacts, but then the contact rankings are scattered and inconsistent over time, thus depicting relatively more volatility than for

the key contacts for the high-resilience condition. Specifically, for low-resilience organizations, the top 5-6 ranked organizations at each phase show that organizations outside of ego populations were consistently named as contacts (e.g., associations- professional; business- different type; suppliers). Differences in the 6^{th}- 10^{th}- most ranked organizations showed high- resilience organizational networks included turning to employees, endowment/funding sources, business (same type); whereas low-resilience organizations turned more consistently to professional individuals, banks, and media (professional) contacts. These results suggest that low- resilience organizations' networking patterns are more diverse than high-resilience organizations and those organizations that seem to contribute to diversity are those to whom a less resilient organization would sensibly turn (e.g., banks; insurance, government).

The results indicate volatile networks of resource-vulnerable and low-resilience organizations while resource-insulated and/or high- resilience organizations tended to have stable and focused networks. Stronger centrality values in the resource-insulated and resilient conditions also suggest that strong ties to key organizational types were rebuilt swiftly. SO Networks tend to have a mix of within-population alliances and most critical ones appear to be those that shape a community of practice (e.g., associations, suppliers, businesses that are the same type). Also, for these advantaged organizations, a few cross-community alliances such as complementary businesses (business-different type) and endowments/ funding sources and nonprofits are present, albeit at less of a degree than the within- population entities. On the other hand, for the low-resilience and resource-vulnerable, key contacts were scattered across a variety of SO types, suggesting attempts to leave 'no rock unturned.' Their displaced and post-disaster networks were more diverse across SO types than the resilient and insulated counterparts. Regardless of the advantages organizations appeared to have, the predominant pattern of networking was to rebuild their former networks, with pre-Katrina relations being the best predictor of the post-disaster "settled" networks. We next discuss these results in light of this paper's multi-theoretical framework.

Discussion

The interest of this study is on the organizing mechanisms of survival with a particular focus on the role of interorganizational communication. After disaster, organizations engaged in communicative

activities that were shaped by past alliances and also mimicked networking practices prior to disaster. In other words, evidence shows structural inertia as an organizing mechanism of resilience, regardless of a DSO's relative resources. At a more granular level, the types of communicative activities that reflect forms of social capital did vary for resilient and resource-insulated organizations from their counterparts. Specifically, resilient and resource-insulated organizations' networks were more dense, indicating advantages associated with bonding social capital after disaster (i.e., organizations whose networking was marked by more bonding social capital, or density, prior to the storm engaged in the same after the storm, and visa-versa for bridging social capital). On the other hand, low- resilience and resource-vulnerable organizations' networks were more diverse, indicating less efficacy of networking marked by bridging social capital, after a disaster. Note that resource-holding capacity did not correlate with resilience, suggesting the ability for IORs to overcome resource capacity. In other words, an organization does not have to be a resource-insulated business to be resilient. The following discussion thus addresses two key theoretical contributions in terms of (a) structural inertia as an organizing mechanism for recovering organizations, and (b) social capital as a driver of resilience, regardless of an organization's resource holding capacity. The second finding also points to the importance of efficient pre-disaster networking and the development of communities of practice.

Structural Inertia as a Post-Disaster Organizing Mechanism

In this study, past alliances are a driving mechanism in recovery and post-disaster survival. Indeed, pre-disaster links endured and were the focus of post-disaster re-networking. While this finding complements other research about the relevance of established links as IORs evolve (e.g., Shumate et al., 2005), this study illustrates the disaster's impact on the equilibrium of the network and the change of networks over phases of rebuilding. Indeed, unique about this study is that these organizations' networking patterns revealed a swifter return to pre-disaster conditions for resilient and resource-insulated organizations. In other words, while structural inertia was the organizing mechanism across organizations regardless of their relative resilience and resource-holding capacity, data show that resilient and resource- insulated organizations' post-disaster networks were more similar to pre-disaster levels in

earlier phases of recovery. On the other hand, the low- resilience and resource -vulnerable organizations did not have networks as closely related to their pre-disaster forms until they were in the settled-phase of recovery when their general state of being was seen as more routine. During displacement and upon their immediate return, these organizations did not have as much access to their pre-disaster networks. We thus assert that structural inertia is an organizing mechanism for recovery but, more specifically, the sooner a DSO has contact with its former partners, the more likely it shows signs of resilience.

Although data showed resource-holding capacity was not a necessary factor in post-disaster recovery, the analyses also reveal that resource-insulated organizations had an edge at getting back to their pre-disaster network levels. The resource-insulated organizations (as detailed in the methods section, those that disseminate financial resources, hold specialized information, etc.) returned to network structures similar to pre-disaster levels in earlier post-disaster phases. This finding echoes past resource dependency research that asserts the vitality of a system relies on such organizations which tend to be more resource-independent and by association, such organizations tend to be more central in their networks (Doerfel & Taylor, 2004; Flanagin et al., 2001; Taylor & Doerfel, 2003). This also supports Uzzi's (1997) point that prior resource sharing and information transfer can lead to the flexibility of networked forms of organizing, thus enabling the swift recovery of the resource-insulated relative to the resource-disrupted. Such organizations could suffer displacement from their region for weeks, suffer the consequences of a city's significantly smaller population in the aftermath, yet show strong evidence of a successful return. While centrality of the participating organizations was beyond the scope of this study, from a resource dependency point of view, these resource-insulated organizations may have the onus of being the community leaders. The very nature of these organizations suggests that their early return to the community could provide the necessary infrastructure for organizations with less resource- holding capacity, which then facilitates rebuilding for the community.

Overall, the stability of DSO networks reflects the notion of structural inertia (Hannan & Freeman, 1984) in that, regardless of resilience and resource-holding capacity, organizations' re-networking after disaster appears to be about getting back to business as usual within the previously

established relationships. Long-term recovery appears to be driven by the patterns of pre-Katrina IORs and not solely on resource-holding capacity. Consistent with Astley (1985), past communication patterns appear to be reified structures that are difficult to change, particularly in times of distress. In other words, these stronger networks (refer back to centrality and density values on Tables 3-6) are an organizing mechanism in organizational survival/ evolutionary processes in post-disaster contexts.

Social Capital and Resilience

Disaster was not a time for building new IORs. For low-resilience and resource-vulnerable organizations, variation in terms of diversity of networks during displacement and immediate phases of recovery may have slowed the survival and recovery processes. Diverse ties may be useful for finding and disseminating information (e.g., they turned to media outlets) but they also reveal how these organizations were extensively networking. Resource-insulated organizations had less diversity and greater concentration (i.e., density) of networking activity in their displacement and recovery networks. This finding points to the relevance of effective networking even before disaster hits, by having intact IORs with these vital organizational types. As a reminder, dense networks in this study means that organizations reported having multiple connections to particular SO types, which facilitates higher centrality for these SOs (Tables 5 & 6). In terms of Burt's (1992, 2000) social capital theory, he recommends structural holes with a balance of effective and efficient links, where the cost of effective ties is redundancy and efficiency's cost is that particular links constrain access to the broader network. In the case of disaster, redundant ties to particular SOs were not a cost (they were effective). Indeed, although diverse links can be an efficient way to span a network, these data suggest diversity's cost is resilience. Moreover, resource-vulnerable organizations might be better served networking to bond; not solely to bridge. Bonding social capital is a form of disaster insurance that could then bolster recovery.

Bonding Social Capital and Communities of Practice

For resource- insulated and resilient organizations, the overall support network was more stable. Types of SOs with strong and consistent ties revealed the organizing forces of specific contacts within a community of practice (i.e., professional associations and businesses- same type) as well as within and

across the broader ecological community (i.e., suppliers, clients, businesses-different type, banks, endowments/funding sources, non-profits, and city government). IORs with these specific contacts retained their usefulness over time and were the central organizations to which the disaster-struck turned before and after disaster. The data also suggest the importance of having multiple ties within SO types, as these ties were consistently stronger for resilient and resource-insulated organizations in terms of both ease of return and access to resources. Low- resilience and resource- vulnerable organizations had relatively less stable ties (centrality values were lower than their advantaged counterparts), indicating fewer relationships with particular organizational types. In other words, considering how this study's networks were constructed, for the tie to a particular organization to be stronger, multiple organizations within that contact category had to be named (e.g., an organization may has multiple nonprofits as ties). This finding suggests that organizations that forged relationships with multiple contacts within populations bolstered their network-- i.e., they had redundant ties. An emergent tension, then, is if an organization's network is too efficient (minimal ties to maximally connect the network), then the focal organization is beholden to the few other organizations to which the focal organization is connected (Burt, 1992). On the other hand, too much redundancy could exhaust the focal organization's resources. In the case of disaster, the redundancy of links to particular organizational sectors appeared to be an advantage to DSOs, however, this tension needs further empirical tests. Future tests could use both resilience research (Kendra & Wachtendorf, 2003; Weick, 1993) and efficiency/effectiveness of networks (e.g., Burt's structural holes theory) to further examine this tension.

An interesting fluctuation that underlines the power of communities of practice is the movement of businesses (same type) for high-versus low-resilience organizations. The business (same type) fell to 28th place during displacement then eventually moved back up to 13th place for low-resilience organizations (see Table 5). On the other hand, the business (same type) for high-resilience organizations was 6th before the storm, the same during displacement, then improved to 3rd place and stayed there in the aftermath. This variation between low- and high- resilience organizations suggests a few possibilities. First, for low- resilience organizations, their broader community was likely also struggling so much that

they couldn't come to the help of one another. Second, the pre-Katrina relationships might not have been strong enough to sustain and thus rebuilding such ties might not have been deemed as important as others. In light of the high-resilience organizational networks, however, our data suggest that relationships within one's population are important and worthy of organizations' time and attention. Citing analyses from Doerfel et al. (2010), business (same type) did the "thinking" for their disaster-struck colleagues while the victims couldn't think clearly on their own. These within-population organizations continued to support the disaster-struck with supporting information and strategies in later phases of recovery.

Disaster Drives Constraint-Side of Networks

Research suggests that organizational survival is a function of adhering to norms, expectations, and broader practices of peer organizations. Mimetic processes reify these patterns the way an iron cage constrains growth and transformation (DiMaggio & Powell, 1983; Weber, 1952). The data in this study suggest that disaster recovery is a context within which former IORs, retain their importance to the DSOs and are thusly a primary source of information and resources. Put another way, disaster is not a punctuated equilibrium event that affords an opportunity to change. What remains unanswered is the longer term consequences for these organizations. For how long do these former relationships hold steady? Are disasters a time when structural inertia becomes even more difficult to break out of? Returning to disaster and resilience research, some of which speculates that victims often turn outside the realm of expected relationships (Kreps, 1984), these data suggest the opposite. Organizations, regardless of their resource-holding capacity and resilience, returned to former ties and engaged in the same bonding or bridging practices that they mostly engaged in prior to the storm.

The importance of IORs is nothing new in the extant organizational literature (c.f. Adler & Kwon, 2002; Gulati, 1995) yet this study underlines two important aspects to building IORs as part of disaster plans and general business functioning. First, having dense IORs within an organization's population provides strong reliable relationships that can be counted on when disaster strikes. Future tests could use both resilience research (Kendra & Wachtendorf, 2003; Weick, 1993) and efficiency/ effectiveness of networks (e.g., Burt's structural holes theory) to further examine this tension. Second, resource-holding

capacity is sufficient but not a necessary cause of resilience. Having redundant, dense IORs in the professional community, particularly with professional associations, businesses (different and same type), in addition to the obvious ones (e.g., clients, suppliers) are tantamount to disaster survival.

Limitations

This research is qualified regarding representation, methodology, and the subsequent nature of the data. Organizations were biased towards successful rebuilding because they were all back in New Orleans when their leaders were interviewed. The data do not include cases in which organizations had yet to return nor span enough time to identify those that eventually failed. Future research needs to consider the more dire cases of those who have not returned or have lost their businesses. Second, variables like financial data were not consistently available across all cases. This limits findings related to resource dependence because our measure was based on traits; not actual resource holdings. Third, while great care was made at every phase of data management a different team of researchers could glean information from their own interview-based data. Related, data were based on recall, albeit about a poignant event. These decisions resulted in data unlike the quality of data afforded when all members of a system are polled, and can therefore confirm the veracity of relationships. Despite this, the way contacts were coded enabled aggregate analyses of the cases and therefore comparisons across situations, extending the way survey research that identifies individuals' networks (e.g., Hampton et al., 2011) to IORs.

Conclusion

This study extended organizational evolutionary theory to disaster contexts and demonstrated the role of particular IORs to disaster recovery. The findings continue the opportunity/constraint debate about social networks in that disaster appears to reify former communication and networking patterns that may, in the long run, strengthen the iron cage shaped by a community and its emergent norms, practices, and expectations. Despite this inherent network tension, findings underline the way communication networks can be flexible through the course of disaster and facilitate speedy rebuilding in the face of recovery. Overall, the findings underline (a) the extent to which disasters drive the constraint-side of networked forms of organizing because of organizations' reliance on their communities of practice and (2) and that

resource vulnerability can be compensated with IORS. Organizations should recognize the power of communication relationships to stabilize their post-disaster circumstances yet also ensure flexibility within their networks by having multiple ties within particular supporting organizational types.

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[i] Follow up interviews were conducted with a subsample of participants and are not part of this study.

[ii] A total of 64 unique organizations were part of the initial sample. Eight of the original interviews could not be used in this study because of recording problems (n=4), the informant requested to not be recorded (n=3), or the substance of the interview revealed that the organization never reopened and was thusly substantially different than the others in the dataset (n=1).

[iii] Contact the first author for the interview guide [add email address].

[iv]The advantage of ATLAS.ti is that each instance of text that reflects codes can be labeled with all of the appropriate and relevant codes from the entire codebook. Quotes from interviews often revealed multiple theoretical themes and concepts simultaneously. The disadvantage is that a quantitative measure of intercoder reliability cannot be accurately calculated. The coders, however, noted the consistency with which they agreed about identifying episodes that needed coding (episodes could be a single phrase or as much as a paragraph or two) and that their code selections (from the codebook, Table 1) were consistently similar, too. Because of the extensive code list from which they could choose, they did regularly have minor differences about which codes each coder applied to the same episode. In all circumstances, coders were compelled to be sure their disagreements were resolved in a rigorous and thoughtful manner. No "standoffs" ever needed resolving by a third coder.

[v] A chi-square test with Yates continuity correction revealed that the percentage of organizations that were resource-vulnerable did not vary by resilience, χ^2 (1, N=52) = 1.44, p = .23.