iGLUS QUARTERLY

INNOVATIVE GOVERNANCE OF LARGE URBAN SYSTEMS

Vol 3 | Issue 2| September 2017

Local Governance:

Successes and Opportunities

IGLUS Quarterly | Published four times a year, IGLUS Quarterly contains information about Governance, Innovation and Performance of Cities in general. It provides original analysis, information and opinions on current issues. The information and views set out in this publication are those of the author(s) and do not necessarily reflect the official opinion or views of IGLUS/EPFL. The author(s) is solely responsible for the accuracy of the information presented and will be held liable for any potential copyright infringement.

ISSN | 2571-628X

Subscription | The subscription is free. Please do register at www.iglus.org to be alerted upon publication.

Letters | We do publish letters from readers. Please include a full postal address and a reference to the article under discussion. The letter will be published along with the name of the author and country of residence. Send your letter (maximum 450 words) to the editor-in-chief. Letters may be edited.

Cover image | Diego Giron

Publication directors | Matthias Finger

Editor of this Issue | Rebecca Himsl, Maxime Audouin, Matthias Finger

Publishing manager and coordinator | Rebecca Himsl, Maxime Audouin

Founding editor | Matthias Finger

Publishers | Chair MIR, Matthias Finger, director, EPFL-CDM, Building Odyssea, Station 5, CH-1015 Lausanne, Switzerland (**phone:** +41.21.693.00.02; **fax:** +41.21.693.00.80)

Email | iglus@epfl.ch **Website** | www.iglus.org

iglus
INNOVATIVE GOVERNANCE OF LARGE URBAN SYSTEMS

IGLUS.EPFL @IGLUSEPFL company/iglus

European University Institute
ROBERT SCHUMAN CENTRE FOR ADVANCED STUDIES
FLORENCE SCHOOL OF REGULATION TRANSPORT

ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE

EDITORIAL

For decades now, globalization and rapid urbanization have been at the forefront of city building processes culminating in increasingly complex urban environments that defy pre-existent jurisdictional boundaries and hierarchal public management structures. In response, a new form of urban management, termed New Public Governance, has emerged and favors network-based governance systems that emphasize collaboration over management. This transition from 'government' to 'governance' has given rise to new forms of cooperation between public and private stakeholders as well as new forms of citizen engagement and participation that are better adapted to the fragmented and vaguely defined jurisdictions and responsibilities in public management today. Correspondingly, we are seeing a growing prevalence of public-private partnerships and collaboration networks across a wide range of public sectors and governmental scales. In this issue of IGLUS Quarterly, we explore the multi-scale and multi-sectoral nature of today's local governance systems through four different articles that, together, highlight the successes and potential of effective local governance networks.

In the first article, Andrea McArdle discusses the governance challenges that municipalities must address when evaluating climate risk and planning for urban resilience. Illustrated by a case study of New York City's climate resilience initiatives in the wake of Superstorm Sandy, she proposes a list of considerations when planning for coastal retreat and emphasizes the importance of community member engagement.

In the next article, Mariona Tomàs introduces four models of metropolitan governance and explores the factors that determine the effectiveness of a metropolitan governance system. Finishing with an analysis of the Metropolitan Area of Barcelona, she advocates for the necessity of adopting a shared vision amongst all actors and democratic representation in order to attain political relevance.

In the third contribution, Kyujin Jung defines the components and conceptual frameworks that underlie strong community resilience initiatives, and illustrated through a case study of the Southeastern Economic Region in South Korea, highlights the importance of locally formulated close-knit collaboration structures among local interest groups for effective and efficient disaster response.

The final article, by Anukriti Chaudhari, presents us with an example of an opportunity for enhanced local-scale intervention through a comprehensive analysis of India's Energy Infrastructure that highlights the inadequacies of the existing centralized energy system as well as the enormous potential that could be afforded through microgrid development.

We hope you enjoy these four articles and invite you to join the discussion at iglus.org. If feel you that there are innovative practices underway in your city-region and you would like to contribute to an upcoming edition of IGLUS Quarterly, we encourage you to contact us at rebecca.himsl@epfl.ch and maxime.audouin@epfl.ch.

Rebecca Himsl – Maxime Audouin

Climate Risk and Resilience Planning in an Urban Governance Context

Andrea McArdle*

Abstract: Coastal cities confront substantial governance challenges as they respond to projections of rising sea levels and resulting storm surges. The article will outline climate resilience planning considerations that draw on community knowledge and fully address the benefits and costs of both coastal rebuilding and managed retreat.

Climate Risk and Resilience Planning in an Urban Governance Context

Coastal cities confront substantial governance challenges as they respond to projections of continued ocean warming and a global average rise in sea level (IPCC, 2014; Dennis & Mooney, 2016). Climate-related risks implicate a city's capacity and legal authority to manage and mitigate the impact of extreme weather events and to develop climate resilience policies that consider public health and safety, environmental sustainability, and the integrity of a city's built environment and infrastructure. This article considers the proposition that a municipality engages in effective climate resilience policy setting when it takes a wide-angled approach to land use planning based on a cost-benefit calculus that gives equal attention to the economic, structural design, environmental, and human dimensions of proposed initiatives. Drawing on New York City's experience as a case study, the article will propose a set of planning considerations for urban policymakers. It will develop the idea that sound coastal-resilience governance takes into account the perspectives of a broadly envisioned set of community stakeholders and remains open to taking a combination of tailored approaches. These include coastal protection measures, managed coastal retreat with community resettlement, and, when appropriate, rebuilding. Further, the article discusses the value of directly incorporating into governance an equity-based community lens, informed by the needs and experience of vulnerable communities living and working in a locality's flood plain.

Urban authority in a vertical governance paradigm

Municipalities must address directly the impact of extreme weather on their territory, structures, and population, and they have become incubators for developing climate-resilience initiatives. In the context of climate change, resilience has been defined as the "[a]bility to survive and recover from the effects of climate change . . . ability to understand potential impacts and to take appropriate action before, during, and after a particular consequence to minimize negative effects and maintain ability to respond to changing conditions (Rockefeller Foundation, 2009).

Generally, municipal governments exercise regulatory, revenue-raising, and eminent domain powers over land use within their borders, but the capacity of municipal governments to effectuate policy on climate change or any issue is linked to the authority of other levels of government. In the U.S. and other nations having a federal system, for example, cities are positioned on the lower rung of a vertical governance structure in which the national-level government predominates and state (subnational) governments have authority to define the extent of municipal authority (Schragger, 2006). Within this vertical governance paradigm, cities' fiscal autonomy is similarly limited. For example, cities may be subject to mandates attached to funding from higher levels of government (Salkin and Gottlieb, 2012) or subject to various state law limits on authority (Mandelker et al., 2010), such as the authority to issue municipal bonds or to impose taxes.

When a municipality engages in risk management for, or responds to the effects of, extreme weather, it operates within these fiscal parameters, which may complicate,

* Andrea McArdle, Professor of Law, City University of New York School of Law, mcardle@law.cuny.edu

and possibly distort, resilience policy choices concerning land use. For example, when coastal properties are damaged as a result of storm-related flooding, a local government may choose to rebuild or, alternatively, consider various forms of managed retreat, including buyouts of property to facilitate residents' resettlement away from flood-prone areas, and possible nature-based re-uses of coastal land (Siders, 2013; Freudenberg et al, 2016). Such a choice has clear economic implications: a municipality may conclude that the prospect of lost tax revenues and the risk of depressed surrounding property values that would result from buying out and demolishing coastal property (Freudenberg et al., 2016; Rush, 2015) justify expenditure of public money to subsidize rebuilding, even when ecological, public health, and safety considerations would counsel retreat from coastal settlements. In addition to these economic factors, a combination of logistics, geography, and the psychology of place may also influence how a municipality sets and implements resilience policy. New York City's experience in the aftermath of a devastating storm in 2012 offers a case in point.

Resilience Initiatives and Challenges in New York City

The toll taken by "Superstorm" Sandy was severe, including 44 deaths, substantial property losses, extensive damage to boardwalk and waterfront structures, and beach erosion. The impact on vulnerable populations was particularly acute, given the location of numerous hospitals, group residences, high-rise public housing in the City's flood plain (A Stronger, More Resilient New York, 2013; Zarrilli testimony). Under the authority of federal legislation, and after approval by the U.S. Department of Housing and Urban Development, New York received three funding allocations totaling $4.21 billion, which were supplemented by assistance from other federal agencies (NYC Recovery ,n.d.).

The city's principal policy response to the climate risk issues highlighted by the storm was issued in 2013 during the mayoralty of Michael Bloomberg. It included over 250 recommended resilience initiatives requiring a $20 billion investment to (1) protect the city's coastline through hard and soft armoring, (2) strengthen buildings and infrastructure, and (3) support local rebuilding (A Stronger, More Resilient New York, 2013). Mayor Bloomberg's successor, Mayor Bill de Blasio, has largely continued these approaches, while adopting a view of resilience that encompasses community, social, and economic applications (OneNYC: The Plan for a Strong and Just City, 2015).

New York City has 520 miles of waterfront, much of which is highly developed and populated and thus at risk to inundation from storm surges. On the basis of climate scientists' projections, sea level rise in the New York metropolitan area is expected to increase throughout the century, perhaps as much as 75 inches by century's end under the high estimate, and projected to surpass the global mean as a result of a combination of geologic and oceanographic factors (NPCC, 2015). To date, however, the City itself has largely eschewed managed retreat from the waterfront as a resilience strategy, and has continued to approve sites for new development along its waterfront (A Stronger, More Resilient New York, 2013; Rush, 2015; Rice, 2016)[1].

A New York State-administered buyout program, however, offers an example of how a home-owning waterfront community can participate in managed retreat. Upon the petition of local residents in three high-risk neighborhoods along the eastern shore of Staten Island, one of the City's five boroughs, the State purchased properties at pre-storm values with a commitment that the land would not be redeveloped but instead returned to its original state as wetlands. These residents were proactive in forming a buyout committee, gauging the interest of other residents, and identifying vulnerable properties to be included in a buyout (Rush, 2015). At the same time, however, the U.S. Army Corps of Engineers has committed to build a seawall, and the City is funding a rebuilding program, along this same shoreline (Robbins, 2016).

The seeming inconsistency in approaches to resilience among these varying levels of government underscores

1 In a recent development, the City in March 2017 announced the Resilient Edgemere Community Planning Initiative, which contemplates measures to protect a flood-prone neighborhood in the borough of Queens (Resilient Edgemere Comprehensive Planning Initiative, 2017). The Initiative proposes setting aside 16 acres of land to be used as open space, and buying out several properties. The City does not appear to be using its eminent domain powers but agrees to buy out residents who express a desire to relocate from flood-vulnerable areas, a process the City refers to as "de-densifying." However, the City is also reportedly curtailing funding to rebuild properties in the most flood-prone areas of the neighborhood (Kensinger, 2017).

the practical governance challenges at issue. As noted, the City does not act with complete autonomy or in isolation in setting policy but rather is constrained by its position in a vertical governance structure, where other government actors play a role. From a fiscal standpoint, if the City pursued a retreat strategy, it would incur property acquisition and relocation costs and also stand to lose property tax revenues, unless relocating residents can be given financial incentives to resettle within the City, as the State buyout program provides (Rush, 2015). Moreover, given the City's existing population density and highly developed infrastructure, a resilience strategy of coastal retreat and resettlement could be difficult to achieve logistically (Vision 2020: New York City Comprehensive Waterfront Plan, 2011), even assuming the willingness of City residents to relocate, which often is not the case. For example, although, as noted, the buyout and relocation process for discrete Staten Island neighborhoods was community-driven, across the City many residents are committed to rebuilding, often as a result of a deep sense of attachment to place (Binder, 2013). As psychological literature documents, disrupting the connections and affiliations that individuals develop over time around place can lead to psychic destabilization and trauma (Fullilove, 2004).

Resistance to relocation can also be rooted in economics: New Yorkers of modest income living in aging, wood-frame, single-family bungalows that proliferated along the City's coastline as an accessible form of property ownership (Brady, 2016; Rush, 2015) could face difficulty securing comparably affordable housing farther inland. Other residents have been reluctant to retreat because they persist in the belief that all waterfront property ultimately will be redeveloped at great value (Rush, 2015).

The logistics of coastal retreat also vary with the typology of community housing or business at issue. In addition to storm-vulnerable single-family bungalows, the City's waterfront is the site of thousands of units of New York City Housing Authority (NYCHA) public rental housing, mostly located in high-rise buildings (NYC Hurricane Sandy After Action Report, 2013). After Superstorm Sandy struck, 402 public housing buildings covering 35,000 units were damaged, and 80,000 residents of NYCHA-owned high-rise buildings were stranded without essential services for several weeks (NYU Furman Center for Real Estate and Urban Policy, 2013). Autonomous community-based groups proved to be key in supplementing the City's efforts to account for and assist vulnerable NYCHA residents after the storm struck (Marans, 2012). Based in part on its experience in superstorm Sandy, the City has since been found legally liable for failure to develop adequate evacuation procedures, and other aspects of disaster preparedness planning, for disabled and elderly persons (Brooklyn Center for Independence of the Disabled v. Bloomberg, 2013). The often compromised circumstances of low-income, special-needs public housing residents underscore the cost, complexity, and logistical difficulties that could ensue if the City were to relocate these and other vulnerable New Yorkers from group and multifamily housing within its floodplain.

Notwithstanding these challenges, the augmented projections of climate scientists for global sea level rise, and the accompanying risk of increasing storm surges and inundation, nonetheless make the issue of managed retreat a relevant consideration for waterfront cities such as New York. The article now turns to outlining a broader set of climate-resilience planning considerations that would help ensure adequate weighing of the benefits, costs, and challenges of retreat strategies on a par with rebuilding. These planning considerations are envisioned as part of a process of community-based engagement and perspective taking that should enable municipal policy makers to grasp more completely the nature of community needs and vulnerabilities, including the bases of resistance, or openness, to relocation.

A Climate-Resilience Planning Template for Urban Policymakers

To develop a sufficiently nuanced process for comparatively assessing rebuilding and managed retreat, policymakers in coastal cities would do well to canvass a full range of variables that can affect decision making, including the environmental and public health and safety risks of rebuilding in coastal areas, the implications for infrastructure and the built environment, the sociological and psychological dimensions of policies that encourage or require retreat, and the economic calculus of pursuing or foregoing retreat. Following is a preliminary inventory to facilitate systematic planning and decision making modeled in part on the National Association for the Advancement of Colored People (NAACP) Equity in Building Resilience in Adaptation Planning (2015), which incorporates an equity-based perspective into climate change adaptation planning:

Geologic characteristics of coastal land/vulnerability to inundation:

- extent of coastal wetlands, landfill
- degree of beach erosion
- extent and nature of vegetation
- extent of natural stormwater drainage
- projections of effects of climate change and sea level rise on coastal land
- potential nature-based re-uses of land following relocation of residents

Built environment in floodplain:

- building typologies, design and type of construction
- extent of single family vs. multifamily housing
- degree of elevation of foundation of built structures above sea level
- degree of insulation of built structures
- isolation/integration of housing with other residences and community services

Location and condition of infrastructure in floodplain:

- extent of constructed stormwater management, sewer connections, utility lines
- extent and condition of waterfront structures (boardwalk, bulkheads, piers)
- extent and structural soundness of transportation infrastructure (roads, bridges, public transit)
- integrity of telecommunications equipment and infrastructure affording internet access

Access of floodplain residents with or without relocation to community services:

- extent of access to reliable food and water sources
- extent of access to secure shelter
- extent of access to medical assistance and counseling services
- access to police, fire, sanitation, emergency, and evacuation services
- access to fuel sources
- extent of access to schools and other educational services

Access of municipal policymakers to community knowledge:

- Inclusiveness of process for identifying stakeholders
- extent of efforts to solicit floodplain residents' views on relocation (community-based charrette , focus groups, town hall meetings)
- process for obtaining and updating data on characteristics of vulnerable populations in floodplain based on age, gender, race/ethnicity, poverty, sexual orientation, immigration status, disability, education level
- information sharing on the comparative health and safety risks, benefits, and costs of rebuilding/remaining in coastal area vis-à-vis relocation
- counseling floodplain residents on availability and extent of relocation assistance
- consultation with specialists on the psychological and sociological dimensions of remaining in coastal area vis-à-vis resettlement

Assessing municipal authority and capacity to initiate managed retreat:

- legal options (buyouts, other financial incentives, eminent domain, use of restrictive covenants to bar redevelopment, acquiring conservation easement, allowing transfer of development rights, creating land banks, creating community land trust)
- extent of expenditure of public money for retreat (acquisition and relocation costs, foregone tax revenues) vis-à-vis rebuilding (cost of reconstruction that meets enhanced code and insurance requirements, regulatory oversight)
- identifying sources of public and private money available to underwrite both rebuilding and resettlement
- determining cost and availability of relocation housing and business opportunities in other parts of the municipality
- impact of resilience policy on maintaining community networks and affiliations.

Conclusion

To reiterate, the foregoing planning inventory is preliminary and suggestive, not exhaustive. Rather, it offers a starting point for municipalities in a process of careful inquiry that should precede any decision making on resilience initiatives. It also bears emphasis that rebuilding

and retreat options are not mutually exclusive; a municipality may choose to use both in an approach tailored to local geography, demography, and built structures. Climate resilience policy makers may not, as in New York, fully embrace the sense of urgency with which some climate scientists have recommended the present use of managed retreat. However, what seems essential to effective governance on this issue is adopting an inclusive, broadly based planning process that incorporates managed retreat strategies into the calculus and ensures that community members' perspectives, experiences, and vulnerabilities are fully considered in decisions either to continue to develop, or to initiate retreat from, the City's waterfront.

References

Binder, S.B., (2013) Resilience and Postdisaster Relocation: A Study of New York's Home Buyout Plan in the Wake of Hurricane Sandy. Available at: https://hazards.colorado.edu/uploads/quick_report/binder_2013.pdf.

Brady, A.F. (2016). Building Back the Bungalow. Available at: http:/urbanomnibus.net/2016/07/build-back-bungalow.

Brooklyn Center for Independence of the Disabled v. Bloomberg (11 Civ. 6690 (JMF)) (2013).

Dennis, B. & Mooney, C. (2016). Scientists nearly double sea level rise projections for 2100, because of Antarctica. Available at: https://www.washingtonpost.com/news/energy-environment/wp/2016/03/30/antarctic-loss-could-double-expected-sea-level-rise-by-2100-scientists-say/?utm_term=.044481386d88.

Freudenberg, R., Ellis, C., Tolkoff, L., and Brawley, D (2016). Buy-in for Buyouts: The Case for Managed Retreat from Flood Zones (Lincoln Institute of Land Policy and Regional Plan Association).

Fullilove, M. T. (2004). Root Shock: How Tearing Up City Neighborhoods Hurts America, and What We Can Do About It (One World/Ballantine Book).

Horton, R., Little, C., Gornitz, V., Bader, D., Oppenheimer, M. (2015). Sea Level Rise and Coastal Storms in Building the Knowledge Base for Climate Resiliency: New York City Panel on Climate Change 2015 Report. Available at: http://onlinelibrary.wiley.com/doi/10.1111/nyas.12593/full.

Intergovernmental Panel on Climate Change (2014). Climate Change Synthesis Report, Summary for Policymakers, 5th Assessment Report, § 2.2. Available at: http://www.ipcc.ch/pdf/assessment-report/ar5/syr/AR5_SYR_FINAL_SPM.pdf.

Nathan Kensinger (2017). A Long-neglected Queens Neighborhood Grapples with the Effects of Climate Change in NYC, Available at: https://ny.curbed.com/2017/4/13/15280808/climate-change-queens-edgemere-photo-essay.

Mandelker, D. R., Netsch, D.C., Salsich Jr., P.W., Wegner, J.W., Griffith, J.C.(2010). State and Local Government in a Federal System (7th ed.).

Daniel Marans (2012). In Coney Island Public Housing, People's Relief and Local Residents Fill Void Left by Government, Huffington Post. Available at: http://www.huffingtonpost.com/daniel-marans/hurricane-sandy-peoples-relief_b_2128733.html.

National Association for the Advancement of Colored People (2015). Equity in Building Resilience in Adapta-

tion Planning. Available at: http://www.adaptationclearinghouse.org/resources/naacp-equity-in-building-resilience-in-adaptation-planning.html.

New York City (2013). A Stronger, More Resilient New York. Available at: http://s-media.nyc.gov/agencies/sirr/SIRR_singles_Lo_res.pdf.

New York City (2013). Hurricane Sandy After Action Report. Available at: http://www.nyc.gov/html/recovery/downloads/pdf/sandy_aar_5.2.13.pdf.

New York City (2015). OneNYC: The Plan for a Strong and Just City. Available at: http://www.nyc.gov/html/onenyc/downloads/pdf/publications/OneNYC.pdf.

New York City (2017). Resilient Edgemere Community Planning Initiative. Available at: http://www1.nyc.gov/site/hpd/community/Edgemere.page.

New York City (2011). Vision 2020: New York City Comprehensive Waterfront Plan, Chapter 3. Available at: http://www1.nyc.gov/assets/planning/download/pdf/plans-studies/vision-2020-cwp/vision2020/chapter3_goal8.pdf.

New York City Panel on Climate Change 2015 Report Executive Summary, Ann. N.Y. Acad. Sci., Available at: http://onlinelibrary.wiley.com/store/10.1111/nyas.12591/asset/nyas12591.pdf;jsessionid=409C26FCCC70D15F6ED2BC756BE640E8.f01t04?v=1&t=j41qhjtz&s=529d423e1f1066706b965b60f1a29c4a00875714.

NYU Furman Center for Real Estate and Urban Policy (2013). Sandy's Effect on Housing in New York City. Available at: http://furmancenter.org/files/publications/SandysEffectsOnHousingInNYC.pdf.

NYC Recovery n.d., Community Development Block Grant Disaster Recovery, Approved Action Plan. Available at: http://www.nyc.gov/html/cdbg/html/approved/action_plan.shtml.

Rice, A. (2016). When Will New York City Sink? Available at http://nymag.com/daily/intelligencer/2016/09/new-york-future-flooding-climate-change.html.

Robbins, C. (2016). Gentrified Aquarium: De Blasio's Streetcar and the Tale of Two Waterfronts. Available at: http://www.villagevoice.com/news/gentrified-aquarium-de-blasios-streetcar-and-the-tale-of-two-waterfronts-9100323.

Rockefeller Foundation (2009). Building Climate Change Resilience.

Rush, E. (2015). Leaving the Sea: Staten Islanders Experiment with Managed Retreat. Available at: http://urbanomnibus.net/2015/02/leaving-the-sea-staten-islanders-experiment-with-managed-retreat/.

Salkin , P. E., and Gottlieb, C. (2012). Engaging Deliberative Democracy at the Grassroots: Prioritizing the Effects of the Fiscal Crisis in New York at the Local Government Level, Fordham Urb. L. J. 39, 727-84.

Schragger, R. C. (2006). Can Strong Mayors Empower Weak Cities? On the Power of Local Executives in a Federal System. Yale L. J. 115, 2542- 2578.

Siders, A. (2013). Managed Coastal Retreat: A Legal Handbook on Shifting Development Away from Vulnerable Areas. Available at: https://web.law.columbia.edu/sites/default/files/microsites/climate-change/files/Publications/ManagedCoastalRetreat_FINAL_Oct%2030.pdf

United States Congress, House Committee on Homeland Security, Subcommittee on Emergency Preparedness, Response and Communications (2016). Testimony of Daniel A. Zarrilli, Senior Director for Climate Policy and Programs and Chief Resilience Officer New York City Mayor's Office. Available at: http://docs.house.gov/meetings/HM/HM12/20160711/105146/HHRG-114-HM12-Wstate-ZarrilliD-20160711.pdf.

Models and variables of metropolitan governance. The Case of Barcelona

Mariona Tomàs*

Abstract: This article deals with metropolitan governance. In the first part, we analyse the models of metropolitan governance and the four variables that affect metropolitan governance: competences, funding, democratic representation and citizen participation, and multi-level relations.

1. Introduction

The process of urbanisation in the world is stable and growing: in less than a century, nearly four billion people will live in urban areas (United Nations, 2015). This trend is expected to grow in the next two or three decades: regions that are currently rural will start to transition towards urban societies, leading one of greatest transformations in human history. In this context, metropolitan governance is a key element in order to face the challenges associated to this process, basically two: social inequalities and environmental problems. First of all, there are major inequalities in urban areas, not only in relation to the income per capita, but also to access to services and goods (education, healthcare, housing, drinking water, food, electricity, etc.). While these inequalities are found in the Global North, they are amplified in the Global South: metropolitan areas have turned into the battlefield for human rights and specifically the 'right to the city' (right to housing, to mobility, to basic services, to culture, to freedom and to participation). In the second place, CO2 emissions have not declined and the quality of the environment has worsened in the air, water and soil: premature deaths from pollution are starting to become an indicator of a problem that requires global and not just local action. The next 20 years will be critical for finding new models of production and consumption leading the transition towards more sustainable metropolitan areas. Social inequalities and environmental problems are undoubtedly related. The lack of access to drinking water or clean air entails a decrease in the quality of life and life expectancy. People who inhabit the most polluted areas in unhealthy conditions are often the poorest, with less equality of opportunity. This vicious circle particularly occurs in the countries of the Global South, where urbanisation processes have taken place in a more disorderly way and with a heavy dose of informality (UCLG, 2016).

2. Metropolitan governance: models and key variables

There are many models of metropolitan governance and no single formula is suitable for everyone.

In fact, each city has its particularities and form of governance due to historical and political reasons. However, we can distinguish four main models of metropolitan governance according to the type of institutional arrangements made (OECD, 2015; Tomàs, 2015):

1) Metropolitan governments or structures expressly created to deal with metropolitan challenges: one-tier (after the merger of municipalities or a designation as a 'metropolitan city') or two-tier (maintaining the municipalities, but with a metropolitan level of coordination).

2) Sectoral metropolitan agencies to manage or plan a single service (public transport, the environment, the police, etc.).

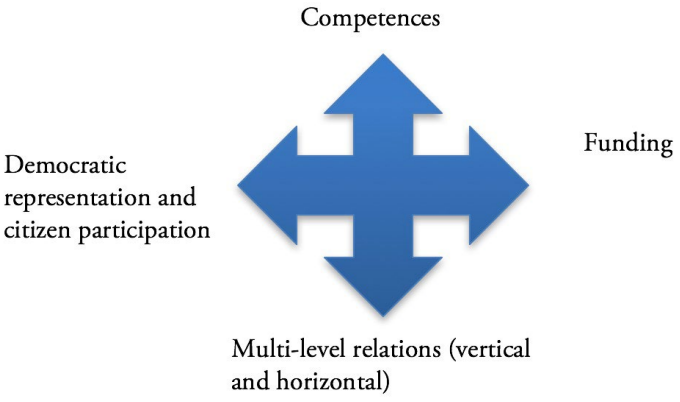
3) Vertical coordination, in which metropolitan policies are not carried out by a specifically metropolitan body, but de facto by other levels of government that already exist (a region, a province, a county, etc.).

4) Less institutionalised models based on municipal voluntary cooperation, whether through a grouping or association of municipalities, or by means of strategic planning.

*Mariona Tomàs, Professor, University of Barcelona, marionatomas@ub.edu

In Europe, institutional fragmentation exists in most metropolitan areas and models with an average degree of institutionalisation prevail: metropolitan governments and voluntary associations of municipalities are in the minority (Tomàs, 2015). This trend may be extrapolated to the countries of the OECD, where 51% of the metropolitan areas have some sort of metropolitan body, but without the ability to regulate and only 18% have metropolitan authorities with powers (OECD, 2015). In practice, models of metropolitan governance evolve over time and vary according to the tradition of cooperation, political alliances, relations between areas of government and the local configuration of public and private stakeholders. Regardless of the model, there are four variables that affect metropolitan governance (Figure 1): competences, funding, democratic representation and citizen participation, and multi-level relations (vertical and horizontal).

Figure 1: Variables of metropolitan governance



First of all, metropolitan areas enjoy no political recognition. In most cases, their competences are related to hard policies (urban planning, public transport, infrastructure, the environment), while they lack competences related to soft policies (education, health, social services, economic development). Furthermore, competences are shared with other levels of government (local, regional or state-related). The binding or non-binding nature of the decisions made must also be taken into account. For example, this could involve determining whether the actions set by an urban metropolitan plan are mandatory or not for municipalities. Without this exclusive and binding nature, it is very difficult to provide solutions on a metropolitan scale.

Secondly, to a large extent, funding determines the degree of autonomy. This is not only true with regard to material resources (the amount), but to the source of this funding (own or by other means). Metropolitan areas lack the financial resources to meet urban challenges: there is little fiscal autonomy, since most of the resources are transfers from other administrative areas. For example, although London has a metropolitan institution (the Greater London Authority), its funding depends on a subsidy from the British government. Therefore, other fiscal instruments are required to develop inclusive policies based on sustainability and solidarity. In fact, it is important to provide fiscal redistribution instruments in the metropolitan territory to reduce inequalities within metropolitan areas, as is the case in Copenhagen, Tokyo and Minneapolis-Saint Paul.

Thirdly, in a few cases, metropolitan areas have directly or indirectly elected metropolitan governments. Indirect election models predominate, where people who have been elected as political representatives in their respective municipalities form part of the metropolitan structure (like in France). There is no great turnout in cases of metropolitan governments selected directly by the people and there are only two examples in Europe: Stuttgart and London. In Stuttgart, after a first vote in 1994 in which turnout bordered on 70%, it began to stabilise at over 50%. In London, turnout has been stable at under 40%, except in the elections in 2008 (45%) and 2016 (46%) (Tomàs, 2015). If we compare this with turnout in the municipal elections, in both cases we see that the percentages are similar. In other words, the direct election of the metropolitan council in both of these agglomerations would not have achieved greater turnout success or differentiated itself from municipal elections.

Finally, metropolitan areas are situated in an environment of multi-level governance, where horizontal and vertical relations exist. In fact, cities have established themselves as political actors that weave their own international networks, like Metropolis, UCLG (United Cities and Local Governments) and the Global Taskforce of Local and Regional Governments. These networks enable an exchange of experiences and best practices that may serve to stimulate policies in other cities and make metropolitan problems visible on a global scale.

We must also take into account how local and metropolitan authorities relate to the private sector. Various public, private or joint venture entities of different territorial scopes, diverse compositions and varied functions operate in urban agglomerations. As such, another challenge of metropolitan governance consists of coordinating them all. In addition, we must guarantee the economic efficiency and viability of the management of the services in areas with major profits like water and those related to the sustainability of the territory. In this regard, there are two interpretations of the metropolitan sphere's opportunities to improve democracy (Kübler & Walti, 2001). On one hand, the private sector's greater involvement in the government of metropolitan areas may lead to less transparency and accountability. On the other hand, the opening of decision-making to other (public and private) stakeholders and the introduction of participatory mechanisms provide an opportunity to involve the citizenry and to improve the quality of democracy.

In addition to relations with other cities and with various sectors of society, the governance of metropolitan areas is affected by relations with other levels of government (municipal, regional and national). In this regard, the political and legal consideration of the municipality and of the metropolitan area is crucial: if it is an important level of government (with competences and funding), if it plays a prominent political role in the country (high turnout in the elections), etc. Moreover, to understand these vertical relations, the importance of the agglomeration in the region or country as a whole is essential (according to its relatively decentralised political structure). In fact, metropolitan institutions with strong powers (legal and fiscal autonomy) and democratic legitimacy (direct election of their representatives) are not created in a vacuum, but in an already existing political structure. The main reason why powerful metropolitan governments are not created is the political resistance generated by this type of intervention from municipalities and from other levels of government that already exist, like provinces, regions or the central government itself. In fact, few governments dare to create new metropolitan governments that group together most of the population of the country and/or capital city. When that has happened, they were given limited powers (of management, implementation and planning) in very specific fields (especially transport and the environment, and to a lesser extent spatial planning and economic development). Political recognition of metropolitan areas therefore requires acceptance by higher levels of government, which are those that legislate and determine their capacities.

3. The case of Barcelona

The metropolitan area of Barcelona is the urban core of a larger city-region and accounts for almost 60% of its population. It has 3.2 million inhabitants and thirty-six municipalities; most of them are immediately contiguous and some cities are physically adjacent to Barcelona and connected by subway. Traditionally, debates on metropolitan governance have been centred on this territory. Indeed, the City of Barcelona (1.6 million inhabitants) and the inner ring have shared the same institutional organization, regional plan, and management of services for the last forty years. We can distinguish four phases of metropolitan governance, ranging from more institutionalised models (1974-1987, and a new metro government since 2011) to institutional fragmentation (1987-2003) and metropolitan cooperation (2003-2010) (for a history of metropolitan governance in Barcelona, see Tomàs 2016). Today Greater Barcelona is ruled by a metropolitan government, the Metropolitan Area of Barcelona (MAB), officially constituted after the local elections of May 2011 in accordance with Law 31/2010 passed by the Parliament of Catalonia.

In relation to the key four variables of metropolitan governance, the MAB has responsibilities in hard policies, such as urban planning, public transport and environment; the services (public transport, water supply, sewage) are provided by public and private companies. The MAB has also powers in economic development and social cohesion. However, all these competences are shared with local and regional governments. Concerning the funding, the MAB has two main sources: transfers from other levels of government (municipalities and other levels of government) and own taxes and fees. The MAB has a system of redistribution, where the City of Barcelona contributes in a larger proportion to its funding.

As for the democratic participation, the MAB is an indirectly elected local government. The municipality is ruled and administered by the council, formed by councillors of each municipality according to their population, and the mayor (currently the mayor of Barcelona), elected by the councillors. As some studies have shown, the majority of citizens are not aware of the existence of the MAB (Vallbé, Magre & Tomàs, 2015). Indeed, the process of metropolitan institutional building and the

strategic planning that exists at the metropolitan scale since the 2000s have been exclusive to political elites and more important organized groups. Moreover, the role played by the metropolitan representatives continues to be marginal in the whole political system. This is explained by the fourth variable, that is, the fact that the MAB is embedded in a multilevel governance system, formed by local, regional, and national levels. The relationships between the Catalan government and the Spanish government, the Catalan government and the City of Barcelona, and the City of Barcelona and suburban municipalities, all affect metropolitan governance and explain why the metropolitan area has not emerged as a collective actor.

The national government has powers in local government by general laws that affect their responsibilities and financing system. The Catalan Parliament—respecting the constitutional principles regarding local government—decides the number of municipalities, the existence of other levels of government, and the creation of metropolitan areas. For almost 40 years of democratic rule in Spain, there have not been incentives to promote the consolidation of metropolitan areas as institutional arrangements to deal with complex urban issues. Because of the specific features of the Spanish political system—and specifically those features that refer to its territorial structure—the consolidation of Autonomous Communities has been the priority. Indeed, the development of other forms of local autonomy, which could potentially challenge the power of the new and emerging political actors, has been systematically postponed to a later stage. Metropolitan governance has not been a prominent issue on the political agenda, neither at the national level, nor at the individual level of each Autonomous Community.

Moreover, Barcelona is the political and economic centre of Catalonia. As in other metropolises, the relationships between the two levels are complicated because of the distribution of powers (Keil et al., 2016). Indeed, the new metropolitan authority applies to thirty-six municipalities: limiting the new metropolitan authority to 3.2 million inhabitants instead of almost five million (the metropolitan region) is undoubtedly a political choice (keeping the metropolis "under control" in a region of 7.5 million inhabitants). Finally, the metropolitan area has difficulties in emerging as a collective actor because of the resistance of the municipalities themselves. Municipalities provide the basic services for the day-to-day life of citizens and are their closest level of political representation. In the Spanish context, this is especially relevant in urban areas. Although the sharing a common vision of the metropolitan challenges has been strengthened since the 1980s, the perception that the City of Barcelona tends to dominate the metropolitan area has not faded away and mayors from the metropolitan area claim for local autonomy.

As for the relationship with private actors, since 2000 the Strategic Metropolitan Plan serves to identify and promote strategies for the economic and social development of the metropolitan area, gathering representatives from the 36 municipalities and other actors such as employer's organizations, trade unions, chambers of commerce, Fair of Barcelona, Port and Airport of Barcelona, University of Barcelona, and other administrations. However, most of these actors are physically rooted in the City of Barcelona: there are no relevant actors with a metropolitan basis. Social movements also lack a metropolitan dimension: they are rooted in neighbourhoods and cities, or have a wider regional scope (e.g., the Autonomous Community of Catalonia). Moreover, the MAB participates in many international networks, but mainly with the leadership of the City of Barcelona.

To summarise, the metropolitan area of Barcelona has a highly institutionalised model of metropolitan governance but, at the time being, has not emerged as a political actor. The MAB remains a functional level for the provision of services, although it has the potential for further development.

4. Concluding remarks

Metropolitan governance depends to a large extent on the competences, funding and recognition that metropolitan areas are given by higher levels of government. Likewise, metropolitan governance must include mechanisms for democratic representation and civic participation to legitimise its decisions. Metropolitan governance is also about creating a shared vision among all public and private stakeholders. A metropolitan institution may formally exist, but there must be a political will for it to work successfully. The case of Barcelona illustrates very well the importance of all these variables in the complex process of building a shared vision on metropolitan challenges.

References

R. Keil, J-A. Boudreau, P. Hamel & Kipfer, S. (Eds.). (2016). Governing Cities Through Regions: Transatlantic Perspectives. Waterloo, ON: Wilfrid Laurier Press.

Kübler, D. & Wälti, S. (2001). Metropolitan governance and democracy: how to evaluate new tendencies? In Mclaverty, P. (Ed.). Public participation and developments in community governance. Aldershot:Ashga: 115-140.

OECD (2015). Governing the City. Paris: OECD Publishing. DOI: http://dx.doi.org/10.1787/9789264226500-en

Tomàs, M. (2016). Explaining Metropolitan Governance. The Case of Spain, Raumforschung und Raumordnung, DOI: 10.1007/s13147-016-0445-0

Tomàs, M. (2015). Metropolitan governance in Europe. Models and challenges. Barcelona: Metropolitan Area of Barcelona.

Vallbé, J.J.; J. Magre & Tomàs, M. (2015). Being metropolitan: the effects of individual and contextual factors on shaping metropolitan identity, Journal of Urban Affairs, DOI: 10.1111/juaf.12243.

UCLG (2016) GOLD IV Report: Co-creating the urban future. Edition 2016 http://www.gold.uclg.org/reports/other/gold-report-iv.

United Nations, Department of Economic and Social Affairs, Population Division (2015). World Urbanization Prospects: The 2014 Revision, (ST/ESA/SER.A/366).

Sources of Community Resilience in Self-organized Collaboration Networks: Lessons from the Southeastern Economic Region, South Korea

Kyujin Jung*

Abstract: Building resilient communities is often a complicated process that can only be achieved through inter-organizational collaboration. This paper aims to examine the essential role that working across levels of governments and sectors plays in building resilient communities by focusing on sources of community resilience and a strong commitment. Findings from the Southeastern Economic Region in South Korea indicate that the key to enhancing community resilience is predominantly connected to the locally formulated close-knit collaboration structures that are based on strong commitment.

Introduction

Building community resilience is a complex and dynamic process that plays out over multiple scales of public, private, and nonprofit organizations. Under fragmented local governance practices and resource limitations, interorganizational networks, comprised of governments, private firms, and non-profit organizations, play an important role in promoting successful adaptation to adversity (Andrew and Carr, 2013; Jung, 2013; Jung and Song, 2015; Jung et al., 2017). The importance of building community resilience – characterized by a community's ability and capacity to respond and recover damages from disasters – has also received much attention by federal, state, and local policymakers (Norris et al., 2008). The concept of community resilience gained wider interest after the adoption of the Hyogo Framework for Action 2005-2015 and the Sendai Framework for Disaster Risk Reduction 2015 - 2030, which call for the need of community resilience research (Manyena, 2006; Jung, 2017). By focusing on four sources of community resilience, this paper aims to examine how a strong commitment, realized through joint coordination efforts, copes with unexpected local demands and thus contributes to community resilience.

Sources of Community Resilience in Self-organized Collaboration Networks

Community resilience consists of four critical sources: Robustness, Rapidity, Resourcefulness, and Redundancy (Bruneau et al., 2003; Norris et al., 2008; Jung, 2017). Each source, derived from interorganizational collaboration, is closely associated with two aspects of a single organization: consideration (i.e., a willingness to offer one's own information and resources to others) and mobilization (i.e., a way to deliver information and resources). In other words, the initial decision to work across levels of government and sectors presents the first challenge for securing sources of community resilience. The second challenge is for all stakeholders to cooperate to develop a method to mobilize necessary resources. By focusing on four sources of community resilience, this paper examines the critical role interorganizational collaboration plays in coping with consideration and mobilization challenges.

The first of these critical sources, robustness, corresponds to the capacity in which a community is able to deal with disruptive disasters without suffering severe or desperate degradations (Bruneau et al., 2003; Jung, 2017). Considering the robustness of initiatives born out of collective action, compared to those initiated through individual response, here local communities can lessen the initial impact of disasters, prevent secondary damage, and even mobilize a greater volume of necessary resources. Ultimately, the consideration of robustness may lead to collective action at the institutional level, which can help ensure better disaster preparation and eventually, reduce costs. Community robustness is achieved through continuous interorganizational collaboration under urgent circumstances. Under a high level of robustness, community resilience will be reinforced by accelerating information and resource flow within in-

* Kyujin Jung, Ph.D. is an Assistant professor in the College of Liberal Arts and Associate Director of the Social Disaster & Safety Management Center at Korea University, South Korea(kjung1@korea.ac.kr).

terorganizational emergency management networks.

Rapidity is the second of the critical sources of community resilience, and it is related to the speed at which an emergency response must be deployed (Jung, 2017). For instance, compared to other types of disasters, a catastrophic event such as the 2013 Oklahoma Tornado strongly requires an immediate emergency response compared to other types of disasters. Through interorganizational collaboration across levels of governments and sectors, the necessary emergency response and recovery processes can be quickly recognized and the degree of the disasters can be rapidly understood. Since each organization involved in an interorganizational emergency management network specializes in a specific aspect of the response and can effectively oversee a portion of the disaster, and as a whole, the interorganizational collaboration is able to issue an almost instantaneous response thereby strengthening community resilience. Thus, a high level of rapidity at the community level can effectively contribute to reducing uncertainty inherent to emergency situations by increasing community resilience and by helping regional communities to prepare for urgent situation more quickly.

Thirdly, resourcefulness is a complicated source that is rooted in the ability to facilitate strong commitment and enhance community resilience (Norris et al., 2008; Jung, 2017). In terms of collective action dilemmas, organizations engaged in interorganizational emergency management networks are typically faced with a high level of uncertainty and risk, and decisions are made once the parties involved have considered the mutual provision of their own resources. Generally, disasters affect a broad region, meaning more than one local community might experience the emergency simultaneously. Resources are limited and must meet the demands of victims and account for property damaged during the catastrophic event, and in order to overcome the associated uncertainties, effective strategies for mobilizing resources should be prepared before disaster. For this reason, effective resource mobilization for enhancing community resilience can be achieved through effective interorganizational collaboration.

Redundancy is the final essential source and is tightly interconnected with the other three sources of community resilience (Bruneau et al., 2003; Jung, 2016). Since the mobility of information and resources in disaster situations is limited, securing redundant pathways to seek accurate information and appropriate resources proves invaluable for efficiently coping with catastrophic events. That is, although communities may not have enough resources or the internal capacity to handle disasters on their own, interorganizational collaboration, when based on strong commitment, can enhance pathway redundancy and facilitate better resource coordination. This source is in some ways similar to resourcefulness in that interorganizational collaboration helps members in shared emergency planning not only to prepare for relatively rare disaster types but also to manage the frequent disaster situations more effectively with and efficiently. Therefore, interorganizational collaboration backed by strong commitments ensures a high level of redundancy at a community level by efficiently seeking out the best way to transmit appropriate information and resources.

Previous literature on intergovernmental and interorganizational relations has identified two general network structures to explain the social positions of local actors: bonding and bridging structures (Andrew and Carr, 2012; Jung and Song, 2015). Interorganizational relations, measured as network statutes, provide a crucial perspective on the motivations behind local government participation in emergency management networks organized by regional authorities or self-organized at the regional level.

Bonding structures can provide diverse resources for building community resilience by utilizing both direct and indirect relations within a network, while a bridging structure presents local actors with resources that are shared with disconnected actors in the network (Jung and Song, 2015). Local governments in bonding structures are assumed to have the ability to exchange resources directly with those that are in close social proximity as well as with actors with whom they are indirectly linked. In contrast, in a bridging structure, an actor can utilize information provided by a central actor who has ties with others who are not directly linked to the actor. While the bonding and bridging network structures have been tested in other fields (Andrew and Carr, 2012), the extent to which individual positions in the network provide tangible and intangible sources that are of value at the regional level is not well understood.

Case Analysis on the Southeastern Economic Region, South Korea

In this section, the bonding and bridging strategies are examined by a case study of local governments, fire and police stations, and nongovernmental organizations in the Southeastern Economic Region (SER) of South Korea. The region consists of three provincial level governments: Busan Metropolitan Area, Ulsan Metropolitan Area, and the South Kyeongsang Province. In the context of the Korean national economy, the SER has been considered one of the most important industrial regions and is where global enterprises such as Samsung, Hyundai, and Kia factories are located. However, the SER has experienced a range of historically catastrophic natural disasters. According to Jung (2013), for instance, the SER had experienced a significant number of tropical typhoons in the last decade costing an estimated $ 4 billion in economic losses (accounting for 23.7% of the total damages). As shown in Figure 1, the typhoons typically led to overflows of water along the southern coastlines and heavy runoffs from the Nakdong river basins. In 14 September 2003, for instance, the strongest typhoon Maemi struck the SER since meteorological records began in 1904. Approximately 3,355 (i.e., 85.4% of the total affected firm) businesses in the SER closed down or went bankrupt with estimated an $ 546 million (94.7% of the total damage) by the typhoon.

Self-organized collaboration networks in the SER were identified through a snowball sampling method. Initially, 43 local governments in the SER were contacted in July 2012, and asked to list up to five organizations they frequently communicated with during emergency response. The process resulted in a list of 170 organizations including national and provincial governments. A structured survey about community resilience was sent in August 2012 to 170 organizations. A total of 130 organizations completed the questionnaire (with a response rate of 76.4%). The survey was also pilot tested on 20 local governments (i.e., 5 cases in each Busan and Ulsan metropolitan areas and 10 cases in the South Kyeongsang province).

A semi-structured interview technique was also used to interview 30 key informants who were directly responsible for processing and/or providing services on behalf of their organizations in the affected communities. The interview guideline was developed around the following three research questions: (1) With whom did your organization/agency coordinate joint efforts to provide emergency services in the phase of disaster preparedness?; (2) What are the key issues surrounding their coordination planning and the modification they made in order to meet communities' needs for services before a disaster?; and (3) Given the nature of the disaster, what types of resources being deployed and utilized to ensure local communities are able to bounce back from a disaster?

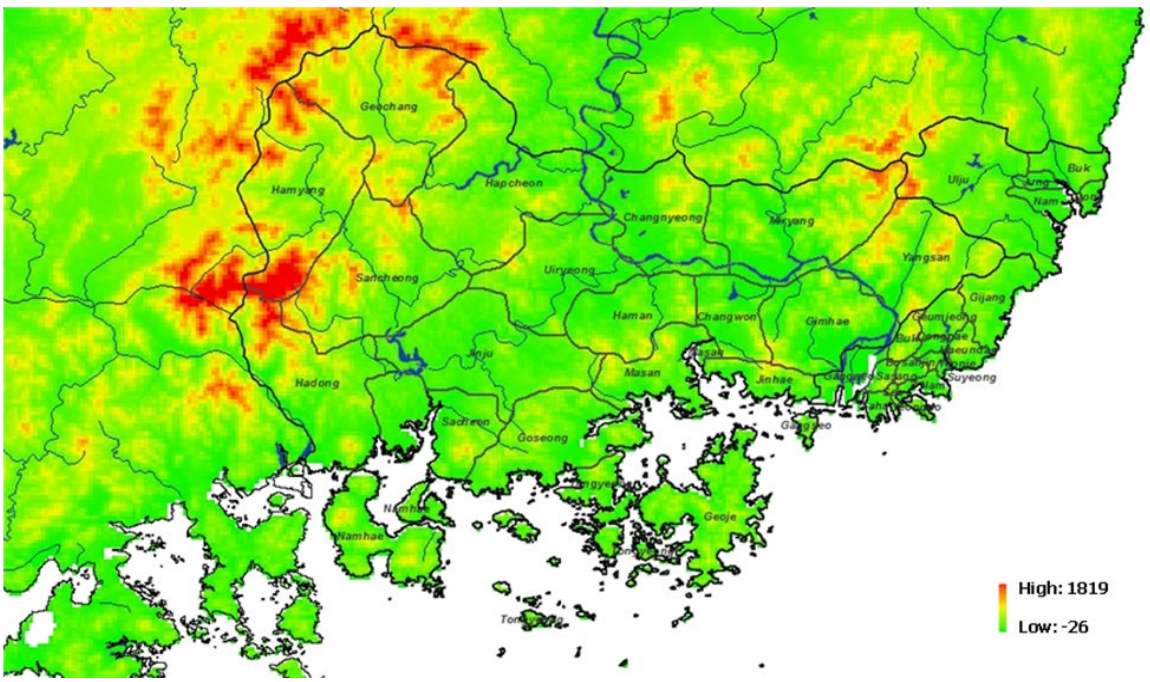


Figure 1: The Southeastern Economic Region in South Korea.

Discussion

Considering the results of the survey and structured interviews, bonding and bridging structures embedded in self-organized collaboration networks provided us with a useful lens to understand how patterns of collaboration manifested across geographical boundaries and sectors, as well as how levels of disaster responders could enhance a community's ability to bounce-back after a catastrophic event. Although community resilience should be considered as a result of important collective activities, previous literature has overlooked the effect of actor's social positions within their regions. Results from the case analysis in the Southeastern Economic Region indicate that a close-knit network structure emerged from a self-organized collaboration network in the phase of disaster preparedness, while sparse, bridging network structures are less likely to be anticipated. These results also present strong evidence to support the claim that local organizations are more likely to be directly linked in dense clusters facilitating joint activities in interorganizational emergency management networks. That is, building community resilience is facilitated by local governments working closely together, which implies that closely linked organizations generate trust and mutual reliance on regional emergency response and recovery through shared goals and information.

Bonding structures based on reciprocated relations are critical sources for building resilient communities. To facilitate closely connected intergovernmental relations, national and regional agencies need to encourage local governments to participate in regional emergency management committees. Various regional level groups focusing on specialized hazards and disasters (e.g., coastal tsunamis or riparian inundation) permit emergency managers to evaluate the feasibility of emergency response and recovery plans, build collaboration with private and nonprofit organizations, and create guidelines for utilizing informational technology (Jung and Park, 2016).

The continuous interactions among regional organizations are also important for the acquisition of valuable resources creating positive results through collective action. When local governments prepare for latent hazards and damages by strategically reinforcing reciprocal relationships with regional organizations, they should not only develop plans to mitigate uncertainties and risks, but they should also promote the mutual interests of local communities (Song and Jung, 2015). From this point of view, bonding effects on resilient communities should not be underestimated. The overall self-organized collaboration network is presented in Figure 2.

Conclusion

This case analysis provides two contributions to the study of self-organized collaboration networks in general and emergency management in particular. First, understanding community resilience can be considered as a set of adaptive capacities that focus on resource mobilization and facilitate successful adaption to unpredictable adversities. Since resource mobilization and information

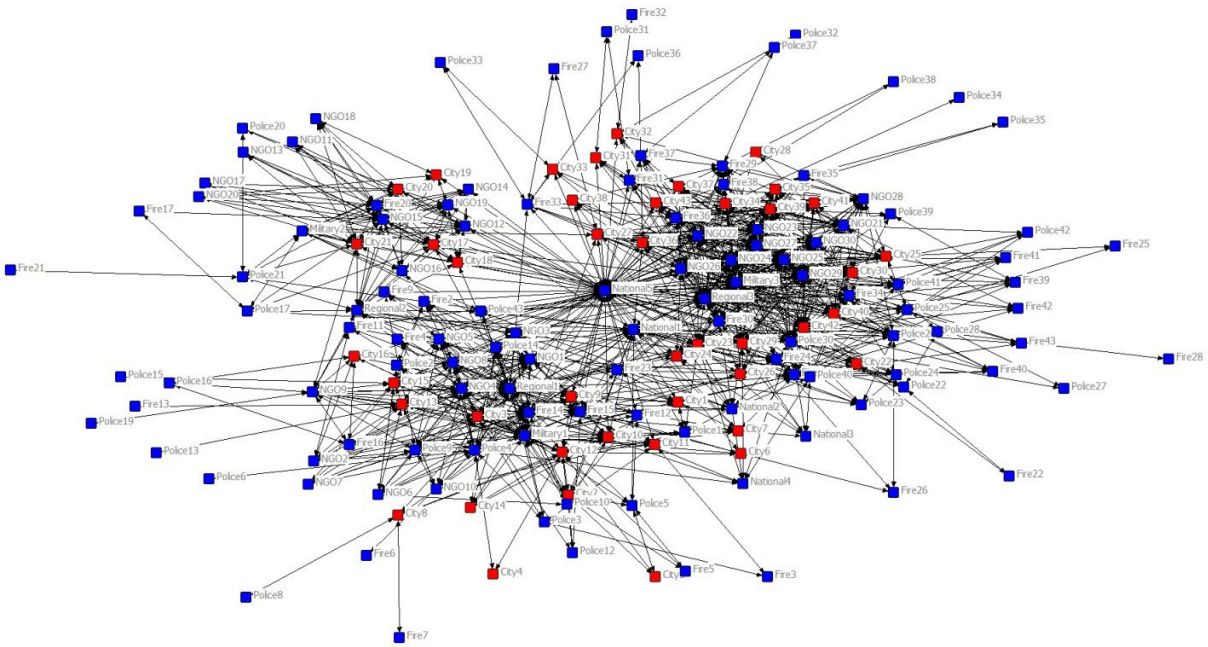


Figure 2: Self-organized Collaboration Network in SER, South Korea

access are principally derived from interorganizational coordination, the importance of social positions provides insight into the sources of community resilience. Second, a dimensional perspective fills a gap between the concept and measurement of resilience. The dimensions of resilience allow us to measure the concept by utilizing various aspects of adaptive capacity to function during and after any type of disaster. Robustness, rapidity, resourcefulness, and redundancy employed in this case analysis show that these dimensions are perceived differently by each disaster response organization. In order to foster community resilience under the fragmented managerial authorities, local government and regional agencies in countries suffering catastrophic events should present diverse platforms for organizations to interact and where they can actively communicate and are closely linked with each other i.e., through bonding structures. Based on those platforms, local governments and collaborators can exchange timely information, build trust, and develop plans for shared responsibility before a disaster strikes.

Fragmented authorities derived from working across levels of governments and sectors is a common challenge in public management, but still it is distinguishable in the field of emergency management. Catastrophic events such as earthquakes and tornados exceed the capacities of a single community and absolutely require interorganizational collaboration. One of the most critical concerns is the way interorganizational collaboration effectively copes with the high level of uncertainty and risk rooted in fragmented authorities. Empirical studies suggest that potential benefits from collaboration rely on internal capacities, such as leadership (Valero et al., 2015); institutional capacities based on communication infrastructure (Jung and Park, 2016); and local communities' characteristics (Jung, 2017). In addition to these conditions, fiscal constraints and a lack of resources have also been recognized as underlying motivations for interorganizational collaboration in the field of emergency management.

Insufficient resources and a shortage of internal finances can present a strong motivation for collaborative action under the condition of fragmented authorities, and a strong commitment may offset the potential risks after a disaster. In general, the purpose of maintaining interorganizational collaboration is to overcome the limitation of internal capacities and to increase the ability to manage a disaster prior to its occurrence. Since interorganizational collaboration without a strong commitment may be ineffective during a disaster, mutual efforts to understand one's own information and resources through full-size emergency exercises and joint professional training are the first steps towards creating an institutional setting for building strong commitment. Therefore, although the collective action problems would be complicated beyond a simple aggregation of benefits, each organization strategically mitigates the uncertainties and risks derived from the fragmented authority by building interorganizational collaboration based on a strong commitment.

References

Andrew, S. and Carr, B. Z. (2013). Mitigating Uncertainty and Risk in Planning for Regional Preparedness: The Role of Bonding and Bridging Relationships. *Urban Studies* 50(4), 709–724.

Agranoff, R. and McGuire, M. (2003). *Collaborative Public Management: New Strategies for local Governments*. Washington, DC: Georgetown University Press.

Bruneau, M., Chang, S. E., Eguchi, R. T., Lee, G. C., O'Rourke, T. D., Reinhorn, A. M., Shinozuka, M., Tierney, K., Wallace, W. A., & vonWinterfeldti, D. (2003). A Framework to Quantitatively Assess and Enhance the Seismic Resilience of Communities. *Earthquake Spectra*, 19(4), 733-752.

Feiock, R. C., & Scholz, J. T. (2013). *Self-organizing federalism: Collaborative mechanisms to mitigate institutional collective action dilemmas*. New York: Cambridge University

Jung, K. (2013). *Community Resiliency and Emergency Management Networks: Following the 2012 Korean Typhoons*. Boulder, CO: The Natural Hazards Center, QR237.

Jung, K. (2017). "Sources of Organizational Resilience for Sustainable Communities: Emergency Management and Institutional Collective Action Perspective." *Sustainability* 9(7), 1141. DOI:10.3390/su9071141

Jung, K. & Park, H. W. (2016). "Tracing Interorganizational Information Networks during Emergency Responses: A Webometric Approach to the 2012 Gumi Chemical Spill." *Government Information Quarterly* 33 (1): 133–141.

Jung, K. & Song, M. (2015). "Linking Emergency Management Networks to Disaster Resilience: Bonding and Bridging Strategy in Hierarchical or Horizontal Collaboration Networks." *Quality & Quantity* 49 (4): 1465-1483.

Jung, K., Song, M., & Feiock, R. C. (2017). "Isolated and Broken Bridges from Interorganizational Emergency Management Networks: An Institutional Collective Action Perspective." Urban Affairs Review. Published online first. DOI: 10.1177/1078087417690257

Lubell, Mark, Mark Schneider, John Scholz, and Mihriye Mete. (2002). Watershed Partnerships and the Emergence of Collective Action Institutions. *American Journal of Political Science* 46(1), 148-163.

Manyena, S. B. (2006). The Concept of Resilience Revisited. *Disasters*, 30(4), 434-450.

Norris, F. H., Stevens, S. P., Pfefferbaum, B., Wyche, K. F., & Pfefferbaum, R. L. (2008). Community Resilience as a Metaphor, Theory, Set of Capacities, and Strategy for Disaster Readiness *American Journal of Community Psychology,* 41, 127-150.

Song, M. & Jung, K. (2015). "Filling the Gap between Disaster Preparedness and Response Networks of Urban Emergency Management: Following the 2013 Seoul Floods." *Journal of Emergency Management* 13 (4):327-338.

Valero, J. N., Jung, K., & Andrew, S. A. (2015). "Does Transformational Leadership Matter in Building Resilient Public and Nonprofit organizations?" *Disaster Prevention and Management* 24 (1): 4-20.

India's Evolving Energy Infrastructure

Anukriti Chaudhari*

Abstract: As the second most populous country in the world, India faces an acute problem of power theft and limited grid penetration, leading to millions still living with erratic or no electricity. With enormous solar potential, falling renewable energy tariffs, improved battery storage and smart metering technology, the country is gradually decentralizing energy distribution through microgrids. By bypassing the national grid, microgrids become more efficient, accessible and affordable.

India's Power Problem

India is the world's fourth largest consumer of energy and is heavily dependent on coal imports to meet its energy requirements. However, despite the high consumption rate, around 300 million Indians continue to live without electricity and 43% of rural India depends on kerosene – thanks to the massively under-developed power-grid. 85% of rural Indian households depend on biofuels such as firewood and cow dung as their primary energy source, which are completely off the grid. Not surprisingly, India also has the world's highest rate of death due to chronic respiratory disease. (Nilekani & Shah, 2015)

In addition to inadequate generation and limited grid penetration, the national power-grid also faces problems of theft and unreliability. A shocking 30% of India's power gets misappropriated by illegal tapping of power lines and electricity meters. As per World Bank estimates, India's power sector could lose up to $27 billion annually by 2017 (Nilekani & Shah, 2015). In a largely state-owned power sector, the state electricity boards are plagued with losses and operational inefficiencies. Peak demand exceeds supply by as much as 15%, leading to erratic power supply and frequent shutdowns (since power grids traditionally do not store energy, improper demand-supply balance leads to power cuts). India witnessed its largest power blackout in 2012 which affected more than 600 million people, about 9% of world population, in 22 out of its then 28 states. This unreliable nature of the grid is why many large companies produce their own costly 'captive power'. Indian companies have 35 GW of private off-grid generation capacity and plan to add another 33 GW. Naturally, this acts as a major bottleneck to the country's economic growth – since small and medium enterprises cannot do so, their expansion is hampered. (Joshi, 2016)

What is being done to address these problems?

The Indian government is on a fervent ride to expand its electricity generation capacity using renewable energy sources. Currently, the utility electricity sector in India has one National Grid with an installed capacity of 330.27 GW of which renewable power constitutes 30.8% (CEA, 2017) – India is also the world's third largest producer of electricity. The country has targets of generating 57% of its total electricity capacity from non-fossil fuel sources by 2027 (the Paris climate accord target is 40% by 2030). Of this 57%, 72GW would be sourced from hydro-energy, 15GW would come from nuclear energy while approximately 100GW would come from other zero emission sources. This is while keeping in mind that expectation that progress in energy efficiency would reduce the need to increase capacity up to 40GW, over the next 10 years. (Safi, 2016)

India's tropical climate allows for enormous solar potential. The solar energy available in a year exceeds the

* Anukriti Chaudhari: Consultant at A.T. Kearney; anukriti.chaudhari@gmail.com

possible energy output of all fossil fuel energy reserves in India. According to Bridge to India, a consulting and knowledge services provider in the Indian renewables market, the country's solar capacity is expected to reach 18.7 GW by the end of 2017 (89% higher than 2016), making it the third-largest global solar market (The Economic Times, 2017). The government is promoting solar energy by increased budget allocations, encouraging private companies by reducing the import duty on solar panels and exempting solar photovoltaic panels from excise duty. The government has initiated a Renewable Energy Certificate (REC) scheme designed to drive investment in low-carbon energy projects. Other incentives include assured power purchase agreements (PPAs) to guarantee purchase of solar power when produced and net metering incentives offering financial incentives for generation when a net meter is installed.

The efforts have certainly not been in vain. Solar prices in early 2017 fell below the traditional coal-generated power for the first time and in absolute terms fell by 30% in the past one year and by 80% in the past five years (Safi, 2016). (Both solar and wind tariffs dropped to their all-time lows of Rs. 2.44 per unit and Rs. 3.46 per unit respectively in 2017 (The Economic Times, 2017)). Although the extremely low prices are obviously a result of a sudden boost in solar power generation and might not be sustainable, the initial decline is surely a positive indication of performance. Foreign investors like Japan's SoftBank and France's EDF have invested in India's renewable energy generation while indigenous conglomerates like Adani and Tata have committed to generating solar power (Safi, 2016). Numerous private ventures are also cropping up thanks to government subsidies and promises of easing business in the energy space. Even in the case of the wind industry, domestic policy support for wind power has led India to become the country with the fourth largest installed wind power capacity in the world (GWEC, 2016). To further build upon its exemplary performance in the renewable energy space, India's energy minister recently took on a challenge to make Varanasi – the world's oldest city and the constituency of the current Prime Minister – to beat Munich in becoming powered by 100% renewable energy by 2025 (The Economic Times, 2017).

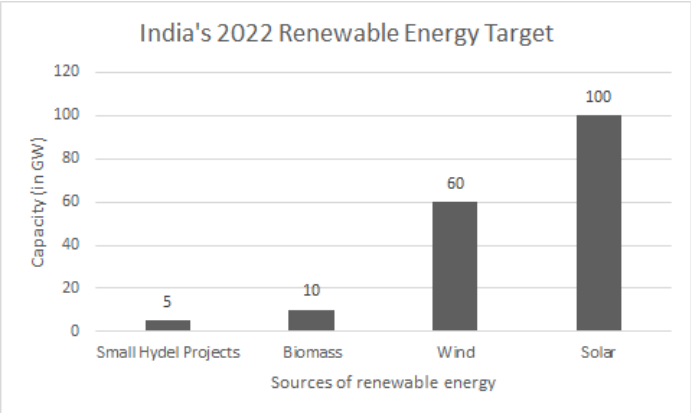


Figure 1: Sources of renewable energy (adapted from the Economic Times, 2017)

Will bolstered generation be enough?

While the ambitious renewable energy targets delineated so far, if achieved, assure resolution of power generation, affordability and even reliability to some extent; problems of grid-penetration and theft remain largely unaddressed.

Penetration of the power grid: The Indian government, like most others, has followed the traditional approach to boosting the power sector by increasing generation without focusing on transmission. So, while there is private sector entry and consequent competition in generation, the distribution sector remains largely unchanged. This drive to boost generation also led to a 'power surplus' in recent years, simply because the government has fiercely promoted generation without reforming distribution (Joshi, 2016). As rightly described by a former Indian union minister: "Chasing gigawatts alone is not enough and will not be sufficient for true energy transformation. What is required is a simultaneous push to ensure decentralized generation and distribution as well so that local communities who do not have access to electricity now get power in their homes." (Ramesh, 2015)

Transmission thefts: With rampant electricity theft, corruption and illegal rerouting of electric wires, it is imperative to have a robust metering system in place. The concept of smart metering is slowly taking shape in India, with 14 smart grid pilots having been launched to push smart solutions in the power generation and distribution industry. As renewable energy generation picks up, these metering solutions must integrate energy produced from multiple sources, including consumers

themselves. They should also be able to monitor energy usage in real-time and deploy advanced analytics to enable energy savings.

The pioneering solution - Microgrids

Large scale photovoltaic (PV) plants in remote sites have poor economic efficiency. Since PV generation is subject to availability of sunlight, which restricts its use to daytime and good weather conditions, it leads to transmission and generation facilities staying idle. Moreover, the generation facilities are required to be set up in remote sites far from consuming regions which incurs high costs for accumulators (Ayai et al., 2012).

Microgrid is a technology that's starting to become popular in many parts of the developing world. Microgrids combine electricity from various sources, such as diesel generators and solar panels with battery storage, and supply a small area with this electricity – instead of relying on large, centralized power plants (Bullis, 2012). This network of local-grid clusters with distributed electricity generation, as illustrated in Figure 2, can bypass or relieve expensive, long-distance, centralized power-delivery systems and bring affordable electricity to the masses. Since microgrids can operate either attached to the national grid or apart from it, they can allow businesses and other organizations to keep going without a hiccup when the main grid goes down. A classic example is the University of Texas at Austin which operates a microgrid that provides 100% of the power, heating and cooling to 150 campus buildings encompassing 20 million square feet. It has done so for more than 40 years with 99.9998% reliability. Clearly, micro-grids can be a robust solution for resilience, reliability and grid-penetration (Wood, 2016).

The technology is especially catching on in India because of the unreliability of the national grid. The head

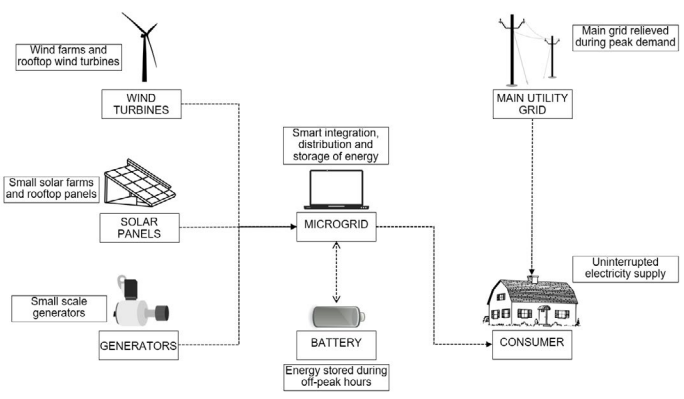


Figure 2: Illustrative model of the future Smart Grid

of green initiatives at Infosys, a software company with 10 campuses across India, each with its own backup power supply, states that Indian companies must make tremendous investments in captive generation as a backup strategy. Infosys is also working on the software that helps control microgrids, thereby increasing transparency and reducing theft (Bullis, 2012).

The conjunctive use of microgrids with advanced software technology could not have been better. While microgrids physically reach remote sites and deliver low-cost power, the software linked to them tracks real-time usage which is displayed on user-friendly interfaces. This not only brings about transparency in the system and eases governance, but also aids in data generation which can be used to detect usage patterns and develop innovative optimization methods for power savings and grid balancing. Hence, if properly designed, microgrids can achieve cost control, reliable energy delivery (through higher generation and accurate demand forecasts) and carbon emission reduction. As India develops, this network of microgrids, with each connected to each other but also able to survive independently, could completely wipe out power blackouts that are currently commonplace in the country. (Bullis, 2012)

The Government of India is looking to generate 40 GW in the next five years through grid connected rooftop solar PV and small scale solar PV plants to provide economic benefits for the people (BS Bureau, 2016). As elucidated earlier, microgrids can serve both as a backup as well as the primary source of electricity. Therefore, for homes not connected to the grid, microgrids can enable functions such as lighting, using appliances, etc. while for those already connected to the grid, it can ensure continuity of these functions. However, even more fascinating benefits of microgrid are its penetration and affordability. For the conventional national grid, reaching remote sites often becomes a herculean task due to distance, weather, terrain or a combination of these factors. Moreover, villagers who depend on daily wages seldom find merit in expensive monthly electricity bills – so chances of recovering the investment made in extending the national grid become close to impossible. With the requirement of much lesser investment and easy access, microgrids become an obvious choice to relieve both conundrums.

An analogy to the telecom industry often quoted while describing the poised energy disruption comes to mind. Ashok Jhunjhunwala, a professor at the Indian Institute

of Technology Madras, elaborates on this in his account on microgrids (2017). He explains how, barring a mere fraction, virtually all Indian homes existed without a telephone connection due to the high cost of copper cables. This was the case even in late 20th century, until the advent of cellphones led to their sudden popularity in the Indian market. Today cellphones offer services which were beyond the scope of conventional landline phones. Jhunjhunwala believes that India's power sector too could follow a similarly disruptive path. The combination of microgrids, smart meters and sophisticated software can most definitely follow a novel route with improved functionality, defying traditional infrastructure.

So how will microgrids prove to be a profitable investment? Jhunjhunwala believes that introducing DC lines will boost the market for DC appliances and gradually wash out the more power-hungry AC alternatives; thereby improving the affordability of microgrids and associated equipment. This will also help in reducing energy consumption from the main grid, which will in turn help in maintaining the balance between supply and demand and obviate the occurrence of power outages (Jhunjhunwala, 2017). Add to this the recent setting up of India's first electric power station and Tesla's anticipated entry into the Indian market, introducing low-cost batteries along-side electric vehicles. Since the power-grid is traditionally built without battery storage in mind, cheap battery storage will prove as disruptive to the energy industry as the cellphone has been to telecommunications (McMahon, 2015).

The Road ahead

India undeniably has a large capacity for renewable resource generation. However, the ecosystem of renewable energy in India is still fraught with constraints, especially with respect to financing. A senior program lead at Council on Energy, Environment and Water (CEEW), a New Delhi-based research organization, regards financing as the biggest bottleneck to achieving the stated renewable energy targets. As per another report by Bloomberg New Energy Finance (BNEF), India needs $100 billion in asset financing for renewable energy over the next six years (Shah, 2007).

The National Institute for Transforming India (NITI Aayog) believes that India must learn to manage the uncertainty of renewable energy generation, and bundle its usage with the existing fossil fuel based power plants. In its exclusive report on renewable energy, NITI Aayog also underscores the importance of capital for India's ambitious targets to succeed. It states that under the 12th Five-Year Plan (2012-17), the Planning Commission had estimated a requirement of more than a trillion US Dollars for infrastructure development, which might be further augmented for renewable energy infrastructures. Financing is, hence, certain to be a challenge. (National Institute for Transforming India, 2015)

It is interesting to note how these concerns find mention in the form of recommended policy changes. The Prayas Energy Group, a non-profit organization working in the energy sector, believes that cost reduction models such as third-party ownership and leasing, aggregators, etc. should be promoted by the government to create avenues for low-cost financing. The group also lays special emphasis on rooftop photo-voltaic (RTPV) systems. It recommends policy changes focused around operational measures such as removal of procedural hurdles and facilitating their quick adoption and deployment. One such example is the city of Bengaluru, a major IT hub with an estimated population of over 8 million, which provides rebates to residents for using rooftop thermal systems and has made them mandatory in all new structures. The group takes one step further and delineates responsibilities for each stakeholder – "The Ministry of New and Renewable Energy (MNRE) should bring a national policy on net-metering, […] the Central Electricity Authority (CEA) should specify metering arrangements specifically for RTPV, […] grid interconnection standards for distributed generation sources should be notified by Ministry of Power, [and] the Forum of Regulators (FOR) should recommend standard guidelines including model regulations and agreements, and specify a very clear and simple institutional structure details of energy accounting, billing, M&V, and mechanisms for interconnection and dispute redressal." (Gambhir et al., 2012). It is thus evident that while the government is taking positive steps to boost generation, a lot still needs to be done in terms of resolving operational and financial constraints to achieve a truly revolutionary revamp of the power sector.

Yet another concern is that a sudden boost to manufacturing might lead to India reneging on the Paris climate accord targets (Sharma, 2017). As alluded previously, India has a shrunken manufacturing sector, partly because of its expensive and unreliable electricity supply. If India's manufacturing sector takes off before adequate supply of renewable energy based generation is estab-

lished, it might have to make a choice between growing manufacturing and keeping firm on its climate commitments. Therefore, not only does India need to continue its current track of energy transformation, it must expedite it to meet its promises. With myriad challenges, reforms and promises on their way, the story of India's energy transformation is indeed eagerly awaited.

References

Ayai, N., Hisada, T., Shibata, T., Miyoshi, H., Iwasaki, T., & Kitayama, K. (2012). DC Microgrid System. SEI Technical Review, 75, 132 - 136.

Bullis, K. (2012). How Power Outages in India May One Day Be Avoided. MIT Technology Review. Retrieved from https://www.technologyreview.com/s/428666/how-power-outages-in-india-may-one-day-be-avoided/

Bureau, B. (2016). ABB and IIT Madras to develop microgrid models for electricity in remote areas. Business Standard. Retrieved from http://www.business-standard.com/content/b2b-manufacturing-industry/abb-and-iit-madras-to-develop-microgrid-models-for-electricity-in-remote-areas-116112100142_1.html

Central Electricity Authority (CEA), Government of India. (2017). All India Installed Capacity. New Delhi. Retrieved from http://cea.nic.in/reports/monthly/installedcapacity/2017/installed_capacity-06.pdf

Gambhir, A., Dixit, S., Toro, V., & Singh, V. (2012). Solar Rooftop PV in India. Pune: Prayas Energy Group. Retrieved from https://natgrp.files.wordpress.com/2013/03/prayas_solar_rooftop_pv_in_india.pdf

GWEC. (2016). Global Statistics. Global Wind Energy Council. Retrieved from http://www.gwec.net/wp-content/uploads/2017/04/4_Top-10-new-installed-capacity-Jan-Dec-2016.jpg

Jhunjhunwala, A. (2017). Innovative Direct-Current Microgrids to Solve India's Power Woes. IEEE Spectrum: Technology, Engineering, and Science News. Retrieved from http://spectrum.ieee.org/energy/renewables/innovative-direct-current-microgrids-to-solve-indias-power-woes

Joshi, V. (2016). Ownership, Infrastructure and the Environment. In India's Long Road (pp. 111-134). New York: Oxford University Press.

McMahon, J. (2017). Batteries Will Do to Energy What Cellphones Did to Telecom: Advanced Microgrid & Tesla. Forbes. Retrieved from https://www.forbes.com/sites/jeffmcmahon/2015/08/24/batteries-will-do-to-energy-what-cellphones-did-to-telecom-advanced-microgrid-tesla/2/#7843244c4322

National Institute for Transforming India (2015, December 31). Report of the Expert Group on 175 GW RE by 2022. Retrieved from: http://niti.gov.in/writereaddata/files/writereaddata/files/document_publication/report-175-GW-RE.pdf

Nilekani, N., & Shah, V. (2015). Switching on our Power Sector. In Rebooting our Power Sector: Realizing a Billion Aspirations (pp. 255-265). Haryana: Penguin Group India.

PTI. (2017). India seen to become third-biggest solar market in 2017. The Economic Times. Retrieved from http://economictimes.indiatimes.com/industry/energy/power/india-seen-to-become-third-biggest-solar-market-in-2017/articleshow/58578390.cms

PTI. (2017). Varanasi to be clean energy city before Munich: Piyush Goyal. The Economic Times. Retrieved from http://economictimes.indiatimes.com/news/politics-and-nation/varanasi-to-be-clean-energy-city-before-munich-piyush-goyal/articleshow/58966091.cms

Ramesh, J. (2015). Gigawatts-plus approach. Livemint. Retrieved from http://www.livemint.com/Opinion/MvWm203A52IBxf3iN72QUM/Gigawattsplus-approach.html

Safi, M. (2017). India plans nearly 60% of electricity capacity from non-fossil fuels by 2027. the Guardian. Retrieved from https://www.theguardian.com/world/2016/dec/21/india-renewable-energy-paris-climate-summit-target

Shah, S. (2017). Why India might not achieve its 2020 renewable energy targets. The Economic Times. Retrieved from http://economictimes.indiatimes.com/industry/energy/power/why-india-might-not-achieve-its-2020-renewable-energy-targets/articleshow/56389839.cms

Sharma, M. (2017). Will Modi keep his Paris pledge or dump it like Trump did? These 3 factors will decide. The Economic Times. Retrieved from http://economictimes.indiatimes.com/news/politics-and-nation/view-this-three-factors-will-decide-if-narendra-modi-follows-donald-trumps-climate-path/articleshow/59056353.cms?utm_source=ETnotifications&utm_medium=autopush&utm_campaign=Politics+and+Nation&utm_content=10PM

Wood, E. (2016). Of Mice and Microgrids: A Profile of the US' Largest Microgrid. Microgrid Knowledge. Retrieved from http://microgridknowledge.com/mice-microgrids-profile-one-us-largest-microgrids/

IGLUS Quarterly

IGLUS Quarterly is an online quarterly publication dedicated to the analysis of **Governance, Innovation and Performance** in Cities and is edited at École Polytechnic Fédérale de Lausanne (EPFL), Switzerland. IGLUS Quarterly aims to facilitate knowledge and experience sharing among scholars and practitioners who are interested in the improvement of urban system's performance in terms of the service efficiency, sustainability and resilience.

IGLUS Quarterly applies the highest academic standards to analyze real world initiatives that are dealing with today's urban challenges. It bridges the gap between practitioners and scholars. IGLUS Quarterly therefore adopts a multidisciplinary perspective, simultaneously considering political, economic, social and technological dimensions of urban systems, and with a special focus on how governance affects and is affected by the use of technologies in general, and especially the pervasive application of the ICTs.

IGLUS MOOCs (Massive Open Online Courses)

Management of Urban Infrastructures

The MUI MOOC provides an introduction to the principles of urban infrastructures management. In this MOOC, you will receive lessons from practitioners (City of Geneva, Veolia, Boston Consulting Group, CarPostal), experts (The World Bank) and academics (EPFL, CUNY). More information below.

iglus.org/mui-mooc/

Smart Cities

Smart Cities is a Massive Open Online Course that offers an introduction to the principles of management of smart urban infrastructure systems. It addresses the main challenges in management of Smart Cities during the transition and operation phases in the life-cycle of a Smart City.

iglus.org/smart-cities-mooc/

European University Institute
ROBERT SCHUMAN CENTRE FOR ADVANCED STUDIES
FLORENCE SCHOOL OF REGULATION TRANSPORT

iglus INNOVATIVE GOVERNANCE OF LARGE URBAN SYSTEMS

EPFL ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE