

SCALING LOCAL WISDOM: GOVERNING CLIMATE RESILIENCE THROUGH NEIGHBOURHOOD CAPACITY

By Dalia Munenzon

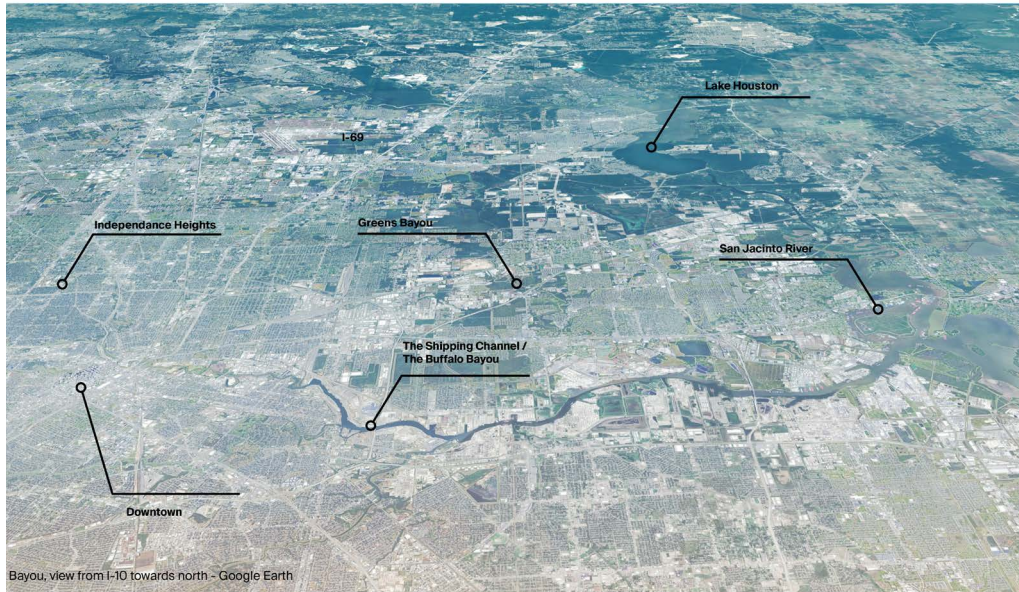


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1. INTRODUCTION

In the two decades since Hurricane Katrina (2005) and more visibly after Superstorm Sandy (2012), climate adaptation has emerged as a critical field linking infrastructure, governance, public health, and social equity. These events catalysed a shift from reactive disaster response to proactive, systems-based planning, integrating long-term urban resilience with environmental and institutional reform (Anguelovski et al., 2016; Barnett & Bouw, 2022). As climate hazards, such as flooding, heatwaves, hurricanes, and others, grow in frequency and intensity, the imperative for cross-sectoral, multi-hazard adaptation strategies has increased (IPCC, 2021; Sovacool et al., 2016).

Adaptation has evolved from a specialized policy silo to a core function shaping how cities govern risk, equity, and investment. Yet, despite expanded funding and planning initiatives, fragmentation persists, competing bureaucracies, political discontinuities, and capacity shortfalls continue to undermine durable action. As Barnett and Bouw (2022) argue,



Figure 01 Conceptual Model of Capacity Gaps and Neighbourhood Strategies. Fragmented institutions and systemic challenges create persistent capacity gaps in adaptation. This model proposes neighbourhood-scale co-production as a strategy to rebuild adaptive capacity through local leadership and governance as infrastructure. (By Author)

meeting the challenge of “futureproofing” urban systems requires not only climate-responsive infrastructure but new governance models capable of addressing deep-seated inequities.

Recent research highlights that capacity, encompassing technical expertise, trust, adaptation literacy, and institutional coordination, is a decisive factor in translating adaptation plans into tangible outcomes (IPCC, 2021; Lotfata & Munenzon, 2022; Susskind & Kim, 2022).

These capacities must be cultivated and embedded in local contexts, particularly in frontline communities that have historically been excluded from planning and investment (Diezmartínez & Short Gianotti, 2022; Chu et al., 2025). Crucially, knowledge pluralism and adaptation literacy are now recognized as foundational to urban resilience: neighbourhoods are not just sites of implementation but vital hubs for the co-production, translation, and use of both formal and informal knowledge. This paper contends that capacity building, particularly at the neighbourhood scale, is not peripheral but foundational to meaningful climate adaptation. Drawing on Houston’s 2022 Neighbourhood, we examine how a city-led, yet community-driven, process institutionalized co-production to build adaptive capacity from the ground up (City of Houston, 2023). Houston’s NRP process provides a lens for understanding how cities can integrate Mētis (Scott, 2020), experiential local knowledge, into governance while advancing procedural justice and fostering durable, systems-level

resilience.

2. BRIDGING THE CAPACITY AND SCALE GAPS IN CLIMATE ADAPTATION

Climate adaptation has become a central theme in global frameworks, yet implementation at the local level remains highly uneven. The IPCC’s Sixth Assessment Report (2021) emphasizes that despite growing recognition

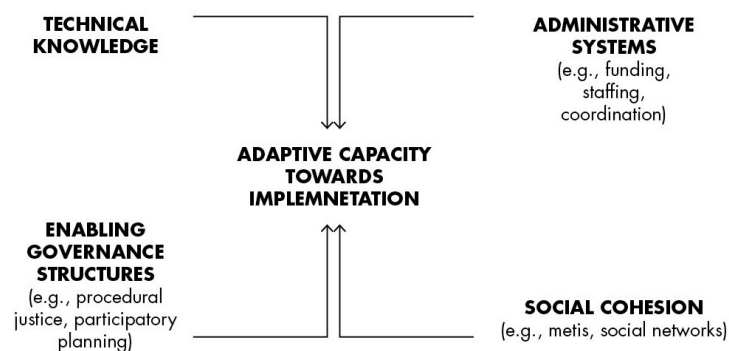


Figure 02 Components of Adaptive Capacity. Urban climate resilience depends on the interplay of technical knowledge, administrative systems, relational trust, and governance structures. Together, these elements form the foundation for legitimate, community-centred adaptation. (By Author)

of adaptation's urgency, many local governments face persistent technical, administrative, and institutional constraints (IPCC, 2021; Kousky, 2021). These capacity challenges go beyond funding shortfalls to include fragmented governance, short planning cycles, limited staffing, and weak interdepartmental coordination (Sobhaninia et al., 2025; Venner et al., 2025). Critically, many cities lack systems that enable long-term learning and collaboration across agencies and with communities.

Adaptive capacity, the ability to anticipate, respond to, and recover from climate impacts, is shaped by a combination of technical knowledge, administrative systems, relational trust, and enabling governance structures (Lotfata & Munenzon, 2022; Susskind & Kim, 2022). Where these elements are weak or disconnected, adaptation efforts often default to siloed, supply-driven interventions reliant on outside expertise. As Susskind and Kim (2022) argue, this model frequently fails to establish self-reliant, locally appropriate systems. They advocate instead for an approach rooted in flexible funding, inclusive collaboration, and iterative, learn-by-doing strategies.

Neighbourhoods, though often underutilized in formal climate planning, offer a vital entry point for bridging these gaps. Their embedded social networks, cultural familiarity, and place-based knowledge make them well suited to advance context-specific and socially grounded responses to climate risks (Meerow et al., 2016; Munenzon, 2024; Schreuder & Horlings, 2022). In many U.S. cities, neighbourhoods already function as informal resilience systems, particularly where formal infrastructure or institutional support is lacking. Yet communities often lack the legal authority, technical assistance, or funding mechanisms to sustain adaptation leadership.

This disconnect is compounded in historically marginalized communities, where legacies of disinvestment and procedural exclusion persist (Shi & Moser, 2021; Smiley & Emerson, 2020). These are not only spatial inequities but also epistemic ones. Localized experiential

knowledge, what Scott (2020) calls *Métis*, is frequently sidelined in formal planning processes. Addressing this requires not just infrastructure but what Engelberg et al. (Engelberg et al., 2025) call emotional infrastructure, systems of care that sustain wellbeing in the face of chronic climate and social stress. Similarly, Ruiz-Mallén (Ruiz-Mallén, 2020) highlights the importance of social cohesion and trust in enabling collective resilience. Participatory and co-production frameworks offer one path forward, reframing residents as co-creators of adaptation strategies rather than passive recipients (Bremer & Meisch, 2017; Chambers et al., 2021). However, such efforts must move beyond tokenism. Without real shifts in power and institutional commitment, they risk reinforcing the very dynamics they seek to undo (Susskind & Kim, 2022).

Neighbourhoods, when equipped with decision-making power and resources, are uniquely positioned to drive transformative adaptation, defined by Shi and Moser (2021) as action that not only mitigates risk but also dismantles the structural drivers of vulnerability. From resident-led housing cooperatives to community-designed green infrastructure, grassroots models have shown that adaptive capacity flourishes when communities shape the processes, tools, and spaces of adaptation (Lamb et al., 2022).

Ultimately, the challenge of climate adaptation is both scalar and systemic. While infrastructure is essential, sustained resilience depends on long-term investment in people, institutions, and governance structures. Bridging the gap between capacity and scale means recognizing neighbourhoods not only as units of vulnerability but as active agents of transformation. The following section examines how these principles were operationalized through Houston's NRP, a pilot initiative designed to institutionalize co-production and build adaptive capacity from the neighbourhood level up.

3. CO-PRODUCTION AND CAPACITY BUILDING: CONCEPTS AND FRAMEWORKS

Co-production provides a vital framework for embedding equity, capacity building, and institutional reform into climate adaptation. Originating in Ostrom's theory of shared public service delivery (Ostrom, 1996), it has evolved into a governance model that brings together multiple forms of knowledge, redistributes decision-making power, and promotes context-responsive solutions (Bremer and Meisch, 2017; Chambers et al., 2021). In climate planning, it means continuous collaboration among governments, researchers, and communities, from risk assessment through evaluation.

At the neighbourhood level, co-production has particular strength. Social networks and localized knowledge make these communities ideal platforms for adaptive responses (Munenzon, 2023). Shared decision making enhances resilience, social trust, and long-term stewardship. Yet co-production also requires confronting entrenched exclusions in planning systems. Chambers et al. (2021) emphasize the importance of participatory spaces and new narratives that elevate communities often marginalized

by traditional planning (Arnstein, 1969; Crenshaw, 2013; Jacobs, 2019).

Urban commons offer a concrete way to operationalize co-production by treating land, infrastructure, and data as shared resources to be collectively stewarded. (Zapata Campos et al., 2023) highlights that commons are defined not only by physical assets but also by the social relationships and mutual care they foster, particularly in communities that have been historically excluded from planning processes. These commons become key to local autonomy and climate resilience. Despite growing interest in decentralized infrastructure, many communities still undervalue the role of social ties and informal institutions. In Japan, residents often prioritized traditional infrastructure over green spaces and relational networks for disaster preparedness (Matharage et al., 2025). This highlights the need for capacity building that supports relational infrastructure, community networks, and organizations that enable collective action. This framing is further illustrated in place-based efforts where community stewardship and shared governance are embedded into climate initiatives.

Community knowledge, grounded in local advocacy and cross-scale collaboration, is a central force in advancing climate resilience throughout Massachusetts. In Chelsea, neighbourhood adaptation is spearheaded by GreenRoots, a resident-led grassroots organization partnering with municipal agencies to co-design equitable climate initiatives. Through efforts such as the “Cool Block” project and collaborative coastal flood mitigation planning, GreenRoots facilitates participatory processes that embed experiential knowledge and procedural justice into city-driven climate strategies. These co-produced initiatives have led to the creation of new public parks, targeted urban cooling strategies, and an expanded urban canopy, collectively centring frontline expertise and fostering sustained stewardship within the community (City of Chelsea, 2025; Horgan et al., 2024; Tracy, 2025)

At a broader watershed scale, the Mystic River Watershed Resilience Collaborative exemplifies how municipalities unite to address climate risks, transcending jurisdictional boundaries. Regional coordination is supported by state programs, such as the Municipal Vulnerability Preparedness (MVP) program, which incentivizes joint projects among regional partners and local community organizations. The collaborative operationalizes networked governance by pooling technical capacity, aligning incentives, and integrating diverse community voices into multi-city adaptation planning. This approach demonstrates how cross-scale partnerships and the resourcing of locally grounded organizations build durable, equitable urban climate resilience while advancing shared infrastructure and investment (Commonwealth of Massachusetts, 2024, 2025; MYRWA, 2025).

Community knowledge, including the forms of experiential insight discussed in relation to Mētis, remains central to effective implementation. When neighbourhoods participate in the design of green infrastructure

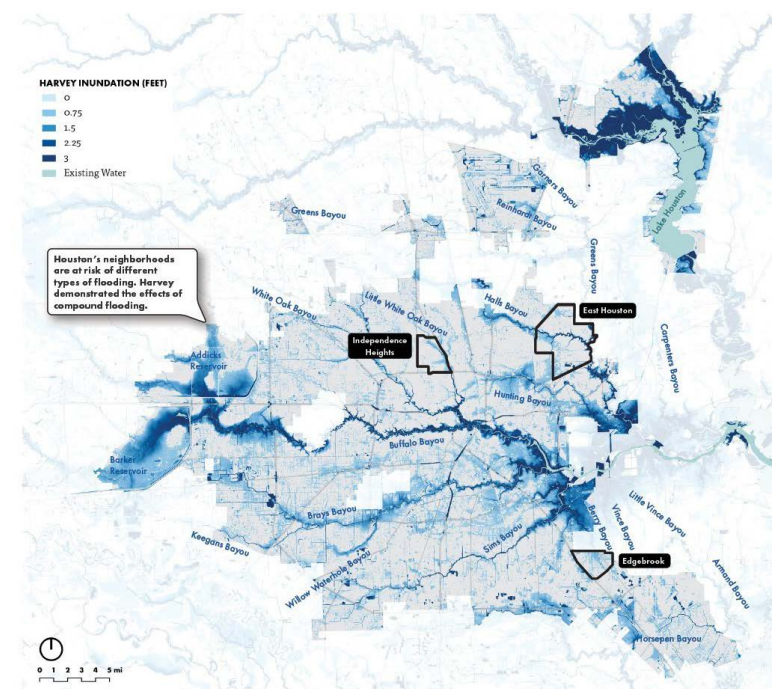


Figure 03 Hurricane Harvey (2017) impact on the City of Houston. Map from the NRP (2023) MAP ATLAS OF BASELINE ANALYSIS. Publicly available document developed by a team led by One Architecture & Urbanism.

such as shade corridors, bioswales, or resilience hubs that integrate solar power and cooling services, the results are often more culturally resonant and ecologically grounded (Meerow et al., 2016; Munenzon, 2024; Zapata Campos et al., 2023). These interventions work not only because they address environmental needs but also because they are rooted in shared responsibility, trust, and long-term maintenance.

Building capacity for climate resilience requires more than technical skills. It involves trust, governance alignment, and iterative learning (Lotfata and Munenzon, 2022; Susskind and Kim, 2022). When embedded in long-term, co-produced efforts, these practices lay the groundwork for durable, community-led adaptation that addresses both environmental risks and systemic inequities. The following section examines how these principles were implemented in Houston through the Neighbourhood Resilience Project, a pilot initiative that institutionalized co-production to build adaptive capacity from the neighbourhood level up.

4. HOUSTON CASE STUDY

4.1 HOUSTON, CLIMATE, AND PLANNING CONTEXT

Houston faces increasing climate hazards, including hurricanes, floods, droughts, winter storms, and heatwaves, which strain infrastructure and disproportionately affect vulnerable populations. Since Hurricane

Harvey, system failures have become more visible: overwhelmed drainage (Statkewicz et al., 2021), utility outages during Winter Storm Uri (Chen et al., 2023), and disruptions from the 2024 Derecho and Hurricane Beryl (Caton et al., 2025; Duan et al., 2025; Li et al., 2025; Voiland, 2024). Beryl revealed stark inequalities; wealthier areas recovered faster, while low-income and Black or Latino neighbourhoods faced longer delays, especially with power outages and closed cooling centres, highlighting environmental justice issues. Similar disparities appeared during Winter Storm Uri. These problems underscore the need for equitable investment in grid resilience and suggest a move toward localized emergency energy solutions. Recent events have further underscored how urban growth and pollution exacerbate systemic climate risks, leading to prolonged power outages and health threats. Addressing these requires integrated governance across land use, air quality, and climate resilience.

Environmental justice communities face concentrated risks: tree canopy loss exacerbates wind damage, power outages impact cooling and access to health services, and flood risk is higher where green infrastructure is lacking (Duan et al., 2025; Guardaro et al., 2022; Li et al., 2025). These neighbourhoods also tend to have less access to healthcare, emergency services, and transportation (Pulcinella et al., 2019). As Munenzon and Noguera (2023) argue, addressing these layered vulnerabilities requires systemic strategies that dismantle disadvantage rather than addressing risks in isolation.

Houston's urban landscape reflects a legacy of redlining, discriminatory land-use practices, and uncoordinated annexation of outlying towns and neighbourhoods. These patterns, coupled with limited public infrastructure investment, have contributed to persistent inequities in access to stormwater drainage, green space, and exposure to industrial and polluting facilities (Hoffman et al., 2020; Munenzon & Noguera, 2023). The city's development has long been shaped by racial segregation, a lack of zoning, and market-driven expansion, factors that have disproportionately burdened communities located near industrial corridors, floodplains, and other environmentally vulnerable areas (Fisher, 1989; Hendricks & Van Zandt, 2021; Qian, 2010, 2011). As a market-driven city, Houston privileges privatized interests and fragmented decision-making over coordinated urban planning (Smiley & Emerson, 2020). In the absence of land-use controls and a centralized planning authority, development often outpaces

infrastructure, leading to growth in high-risk zones and exacerbating exposure to climate-related hazards (Kim & Newman, 2019).

4.2 GOVERNANCE, PLANNING, AND INFRASTRUCTURE DISPARITIES

Houston's infrastructure and service delivery operate within a fragmented web of city departments, county agencies, special-purpose districts, and state authorities. While the City Council and Mayor's Office set policy and oversee core services (Walsh, 2025b), essential systems such as

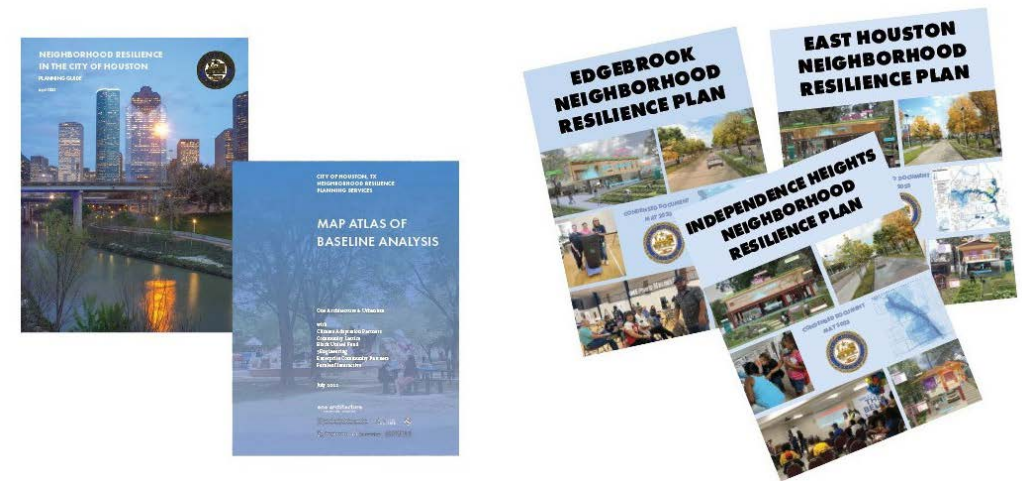


Figure 04 NRP plans 2023, compilation by Author

drainage, flood control, and emergency response are administered by overlapping entities, including the Harris County Flood Control District, Municipal Utility Districts (MUDs), and Water Control and Improvement Districts (WCIDs) (TCEQ, 2025). This jurisdictional complexity often leads to service gaps, inconsistent accountability, and unequal investment across neighbourhoods (Hendricks & Van Zandt, 2021; Woodruff et al., 2021).

To foster local engagement, the City of Houston established the super neighbourhood system in the early 2000s, building on a longer tradition of neighbourhood-based representation (Vojnovic, 2003). These grassroots councils bring together stakeholders from adjacent communities and coordinate with City Hall through elected representatives and liaisons from the Mayor's Office (Carlin, 2025). Houston's early civic club movement laid the groundwork for modern local activism and participatory governance, shaping the city's evolving infrastructure of neighbourhood representation (Vojnovic, 2003). However, the influence of these councils remains limited due to resource constraints, the concentration of power in Houston's strong mayor system, and a lack of formal authority. These challenges are compounded by persistent low public trust, particularly in historically underserved communities (Hart et al., 2024).

This governance context shapes the landscape for climate adaptation efforts. Although initiatives like the Climate Action Plan and Resilient Houston emphasize equity and community involvement (City of Houston, 2020a; b City of Houston, 2020b), implementation remains uneven. The NRP pilot seeks to address many of these structural barriers by fostering co-production and partnership at the neighbourhood scale, working to embed local knowledge and leadership within Houston's fragmented urban governance system.

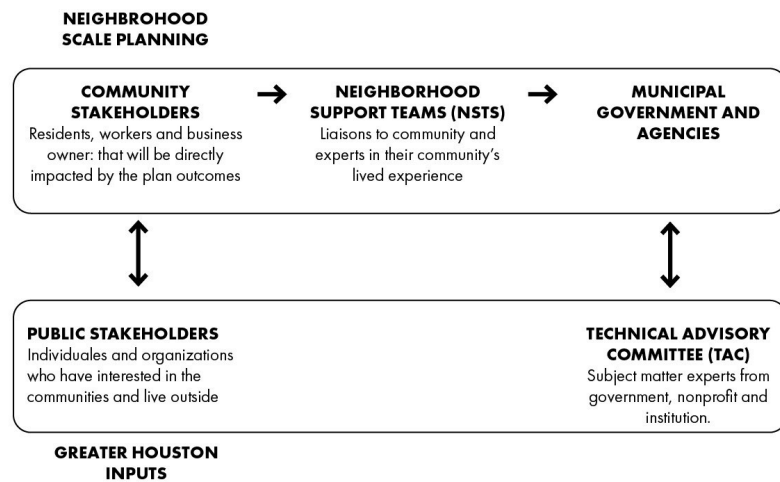


Figure 05 Co-production process structure and involved groups, adapted from NPR documents by the Author.

4.3. NRP: A COMMUNITY-LED MODEL FOR BUILDING CAPACITY

The NRP emerged after Hurricane Harvey as a co-produced planning initiative led by the City of Houston's Planning and Development Department and the Mayor's Office of Resilience (under former mayor Sylvester Turner). Designed to address systemic inequities in disaster recovery and climate adaptation, the pilot focused on three historically marginalized and flood-prone communities: East Houston, Independence Heights, and Edgebrook. These communities were selected for their exposure to flood risk, barriers to institutional recovery, and long-standing patterns of underinvestment. The NRP aimed to embed community knowledge into planning, align public resources with local priorities, and build lasting capacity at the neighbourhood scale.

The process unfolded in four phases: (1) assessment of existing conditions and vulnerabilities; (2) community visioning and goal setting; (3) development of short-term, medium-term, and long-term strategies; and (4) implementation planning. Central to the initiative were Neighbourhood Support Teams (NSTs): small groups of community leaders from civic clubs, faith-based institutions, and advocacy groups, who acted as co-planners throughout. They validated data, shaped priorities, and helped co-design interventions, while developing planning literacy, peer networks, and leadership skills. A Technical Advisory Committee (TAC) of city staff, engineers, researchers, and nonprofit advisors supported the process by assessing feasibility and funding pathways but deferred priority-setting to the communities (D. of P. City of Houston, 2023).

Each neighbourhood brought its own challenges. In East Houston, flooding during Hurricane Harvey damaged critical assets, including schools and libraries, intensifying calls for the restoration of public facilities and economic revitalization (George, 2017). Residents also advocated for heat



Figure 06 Open drain ditches in East Houston. Photo by author.

mitigation through urban cooling along transit corridors. However, the city's proposed planning tools, such as Minimum Lot Size and Minimum Building Line ordinances, placed the burden on residents to navigate complex bureaucratic processes, exposing persistent gaps in accessibility and transparency.

Edgebrook's priorities focused on neighbourhood-level improvements, safe streets, and disaster readiness. NST members emphasized the need for outreach, risk education, and support for navigating municipal systems. They collaborated with police and public works to tackle illegal dumping and improve stormwater drainage. These early wins enhanced community credibility, improved city responsiveness, and demonstrated how organizing can shift relationships with institutions.

In Independence Heights, the oldest historically Black neighbourhood in Houston, residents prioritized housing stability and the preservation of neighbourhood character amid intensifying gentrification and lot subdivisions. Recurrent flooding rendered homes uninhabitable, and some residents faced coercion from developers who used city code enforcement to pressure property sales. The city's proposal to create Conservation Districts offered a potential buffer but required greater institutional backing to ensure community participation and control. Across all three sites, the issue of stormwater ditch maintenance was a recurring concern. Historically installed in annexed low-income neighbourhoods as a low-cost drainage solution, open ditches are now maintained only when residents file 311 requests. Community frustration grew over unfulfilled service calls, jurisdictional ambiguity, and a lack of communication from the city, highlighting how infrastructure failures deepen inequities (Blackburn & Bedient, 2018; City of Houston & Rackleff, 2015).

Despite facing structural and historical obstacles, the NRP incorporated capacity building as a fundamental value throughout its execution. Using

customized engagement approaches, mini-grants, staff liaisons, and skill-enhancement workshops, the initiative boosted local preparedness and facilitated neighbourhood-driven planning. Facilitators played a crucial role in mitigating intra-community conflicts, particularly between newly formed groups post-Harvey and established legacy organizations, by emphasizing shared goals and fostering an inclusive vision. This intentional focus on building trust, procedural fairness, and aligning diverse organizational interests was key to fostering collective leadership, particularly in under-resourced areas where competition for funding and recognition can hinder collaboration.

From a governance perspective, the project demonstrated how co-production can align public services with the lived experiences and aspirations of climate-impacted communities (Chambers et al., 2021; Bremer & Meisch, 2017). However, it also revealed limitations. Many actions remained constrained by city-defined frameworks. Community use of planning tools, such as Conservation Districts or tax increment reinvestment zones (TIRZs), still depended on navigating opaque municipal processes. Most interventions reinforced rather than restructured existing governance hierarchies. The city's provision of leadership training and access to technical resources represented a meaningful step, but it did not constitute a full transfer of decision-making power.

Nevertheless, the NRP offers a scalable blueprint for neighbourhood-centred climate adaptation. It repositions planning as something done with communities, not for them, and centres local knowledge, networked leadership, and institutional linkages as pillars of resilience. As Houston confronts escalating climate risks and socio-spatial inequities, institutionalizing co-production and embedding capacity building into city governance could transform how adaptation planning is practiced, making it not just more inclusive but more effective.

5. DISCUSSION

Houston's NRP exemplifies how *mêtis* and community capacity can be leveraged through co-production to foster fair governance. Community-led assessments, advocacy, and planning directly reflect residents lived experiences, aligning technical designs with local realities and building trust-based legitimacy. Co-designed initiatives, from drainage improvements to community hubs, blend expert knowledge with everyday insights, leading to more realistic and sustainable results (Munenzon, 2024).

The NRP's phased approach—beginning with short-term actions like stormwater cleanups and murals, progressing to infrastructure upgrades, and culminating in long-term, multi-jurisdictional projects, illustrates how co-production scaffolds capacity over time. Tools like Neighbourhood Support Teams (NSTs) and community maintenance agreements formalized local leadership, aligning institutional investments with community-defined priorities. Still, the process revealed persistent

structural limits. Fragmented authority, rigid administrative protocols, and limited flexibility often kept decision-making within conventional frameworks. While the city offered training and limited resources, deep shifts in equity and power remained rare (Nicholls et al., 2025). Tensions around visibility and representation emerged at the neighbourhood level. Facilitators responded through storytelling, visioning workshops, and conflict mediation, emphasizing that emotional infrastructure, trust, historical acknowledgment, and relational care—was critical to sustained collaboration (Lejano, 2023). These relational capacities enabled residents to remain engaged despite bureaucratic delays and resource constraints.

Yet without broader reform, incremental progress may not lead to systemic change. Governance must be treated as an integral part of infrastructure, comprising relationships, accountability mechanisms, and inclusive decision-making pathways (Turnhout et al., 2020; Wamsler, 2017). Capacity-building involves more than technical expertise; it requires sustained investment in civic responsibility and shared institutional memory (Klinsky & Sagar, 2022; Susskind & Kim, 2022).

Barriers, including economic precarity, time constraints, and structural exclusion, continue to limit equitable participation (De Weger et al., 2022; Ravensbergen & VanderPlaat, 2010). Without proper resourcing and institutional support, co-production risks becoming an extractive process. Comparative cases from Uganda, Mexico, and Seattle confirm that successful implementation requires coordination and governance integration (Dierwechter & Wessells, 2013; Huybrechts et al., 2017).

State-led resilience efforts also risk offloading responsibility onto communities. Grassroots initiatives reveal where public systems fall short (Nicholls et al., 2025). Meanwhile, political uncertainty and short-term mandates weaken institutional commitment and dampen momentum (Engelberg et al., 2025). Communicating co-benefits and managing ambiguity must be core parts of adaptation planning.

Ultimately, climate adaptation is most effective when cities embed co-production, local leadership, and transparent governance, especially in diverse, under-resourced contexts (Eidt et al., 2020; Swart et al., 2023). These findings align with broader scholarship on the urban commons, reinforcing the value of *mêtis*, participatory design, and relational care.

Key policy levers for institutionalizing these practices include:

- Mandate capacity-building in adaptation projects
- Fund long-term, neighbourhood-led planning
- Measure governance outcomes—not just physical infrastructure
- Centre frontline communities in every phase of the planning process

- Protect *métis* through formal decision-making protocols

This integrated approach grounds adaptation in equity and accountability, linking policy reform, community power, and localized knowledge systems.

6. CONCLUSION

Houston's NRP illustrates how neighbourhood-scale capacity building, rooted in *Métis*, co-production, and relational care, can lay the foundation for just and durable climate adaptation. By centring local knowledge and enabling residents to co-lead planning, the NRP cultivated trust, civic leadership, and institutional partnerships, reframing resilience as a place-based process of governance (Hart et al., 2024; Munenzon, 2024). These social and governance infrastructures are as critical as physical interventions in preparing cities for a changing climate.

Yet despite its early successes, the project's momentum stalled following a shift in city leadership, revealing a critical vulnerability: without institutional continuity and embedded protocols, community-driven efforts remain fragile (Walsh, 2025b). At the same time, the rise of community-run "hub houses" in flood-prone neighbourhoods demonstrates the adaptive power of grassroots infrastructure. These initiatives underscore that the most reliable safety nets are not policy documents, but embedded relationships and local stewardship (Walsh, 2025a).

Houston's experience offers a broader lesson: adaptive capacity is not a fixed asset, but a system of relationships, knowledge flows, and shared commitments. For adaptation to be effective and equitable, cities must invest not only in what gets built, but in how and with whom decisions are made. Institutionalizing co-production at the neighbourhood scale is not just a best practice; it is a governance imperative for navigating the political, social, and environmental uncertainties of a rapidly changing climate.

7. ACKNOWLEDGMENT

The author thanks the project team, including One Architecture and Urbanism, Community Lattice, and the Black United Fund of Texas, as well as other organizations that supported the research. The author was employed by One Architecture and Urbanism from April to July 2022. During the NRP project, the researcher was invited to observe the process.

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