CHAPTER 7

Climate Resilience in Urban Informal Settlements: Towards a Transformative Upgrading Agenda

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Abstract Informal settlements are on the frontline in the battle against climate change. Home to one billion people, their infrastructure deprivations pose challenges for the health and resilience of communities and ecosystems. Upgrading of informal settlements can improve urban services and infrastructure, strengthen tenure security, and empower local
communities. This chapter examines the conceptual and practice relationships between climate resilience and in-situ upgrading. It critiques prevailing approaches, which centre upon threshold, coping, recovery, and adaptive capacities. Transformative capacity offers greater scope for addressing climate change impacts at a level commensurate with the size of the challenge, and for redressing the entrenched structural inequalities and deep socio-spatial injustices shaping cities in the Global South that perpetuate vulnerability and socio-spatial exclusion. Five elements are identified to advance transformative informal settlement upgrading: socio-technical innovation; a climate justice framing; greater attention to intersectional dimensions; inclusive governance and community empowerment; and fit for purpose finance.

Keywords Informal settlements • Urban poor • Climate resilience • Slum upgrading • Climate change • Housing

7.1 Introduction

Approximately one billion people in the Global South live in urban informal settlements, many of which are highly vulnerable to the impacts of climate change. Informal settlements, also referred to as slums or squatter settlements, generally develop outside formal regulatory and planning systems. They are defined as being groups of dwellings that lack one or more of the following: access to improved water; access to improved sanitation; sufficient living area; durability of housing; and security of land tenure\(^1\) (UN-Habitat, 2003). Occupation and construction take place simultaneously, over many years or decades. These processes are driven by residents who take it upon themselves to meet their housing needs in the absence of formal alternatives that are affordable, accessible, or proximal to socio-economic opportunities and services (Acioly and French 2012).

As a persistent modality of urban and housing development, informal settlements are symptomatic of structural inequalities and the limitations

\(^1\)The fifth measure—tenure security—is excluded from global estimates due to a lack of global agreement on the appropriate measure of this term (UN-Habitat 2016). As such, figures of one billion urban dwellers living in informal settlement conditions under-represent these characteristics globally.
of formal land and housing supply. Although globally the proportion of urban dwellers living in informal conditions fell significantly between 2000 and 2015 (from 39 to 30 percent), the total number of inhabitants of informal settlements increased by almost 100 million (UNDESA 2015:40). With the addition of a further 1.1 billion city dwellers expected between 2015 and 2030, these areas will almost certainly grow in total population over the next decade and beyond (ibid).

Urban informal settlements pose significant environmental challenges for people and ecosystems. Rates of infections and diarrhoeal disease are high due to poor water and sanitation services (Lilford 2017). Informal settlements have higher rates of disease burden and premature mortality than formal areas (Sverdlik 2011). Key environmental determinants of health in informal settlements include spatial segregation, insecure residential status, housing structural quality, water and sanitation, and climate change risks (Corburn and Sverdlik 2019). Women and children are often the most severely impacted by unhealthy informal conditions (Chant and McIlwaine 2016). Ecosystems and the eco-servicing of cities are compromised by the incremental, unplanned encroachment of informal settlements, a process which in turn increases the vulnerability of cities to environmental stressors and shocks such as extreme weather events (Zari et al. 2019). Health pandemics, such as COVID-19, exacerbate the risks and vulnerabilities for informal settlement populations (French et al. 2020).

‘In-situ upgrading’ is a common approach to improve informal settlement access to urban services and infrastructure, while also strengthening tenure security and empowering local communities (UN-Habitat 2015). This approach contrasts that of eviction and the replacement of slums with new housing, which are widely recognised as having detrimental impacts on the livelihoods and social fabric of residents, while also incurring prohibitive financial and political costs for the institutions that deploy them (Pugh 2001). It is within this normative framework and praxis of ‘in-situ upgrading’ that the climate resilience agenda and responses are manifested, particularly when focused through the lens of sub-system vulnerabilities in the cities of the Global South.
7.2 CLIMATE RESILIENCE IN URBAN INFORMAL SETTLEMENTS

The urban poor that informally occupy coastal and riverine areas stand to suffer some of the greatest impacts of climate change. Because of their limited access to formal services, utilities, and infrastructure, informal settlements are generally more sensitive than formal areas to climate-related shocks and stresses, and face increased exposure to an array of extreme and slow-onset climate events (Kabisch et al. 2015). As outlined in Table 7.1, the tendency for informal settlements to occupy otherwise un-developed ‘at-risk’ areas such as intertidal zones and floodplains means that sea level rise and coastal inundation have heightened implications for the livelihoods, health, and wellbeing of their occupants. Increasing rainfall variability and intensity can also exacerbate flooding and waterlogging in the face of negligible drainage and sanitation infrastructure. The increasing frequency of extreme weather events also compounds existing socio-spatial vulnerabilities and strains coping and relief systems (Bulkeley and Tuts 2013; Friend and Moench 2013; Kabisch et al. 2015; Trundle et al. 2019).

The relationship between vulnerability and resilience is contested. In Holling’s seminal writings (1973) on the concept, resilience was observed and defined as a measure of the persistence and absorbance of instability, a characteristic that is integral to the generation of resilience in ecological systems over time. Miller et al. (2010) argue that resilience and vulnerability vary in conceptualisation and theory, methodologies, and practice, despite their common consideration of shocks and stressors. However, if resilience is to be applied normatively to socio-centric systems such as cities, a fundamental social consideration is the redistributive consequences that resilience practice entails. Vulnerability provides a critical entry point into these wider ethical considerations that are often left unconsidered in resilience practice (Olsson et al. 2015).

Climate resilience has become an increasingly prevalent planning framework for urban governance, design, and development, including in the Global South. Within the ‘resilience turn’ in urban policy (Meerow and Stults 2016), ‘urban resilience’ and ‘climate resilience’ have emerged as two of the most frequently referenced contemporary modes of resilience thinking over the last decade (Trundle 2020). In both instances, respective considerations of urban subject systems and anthropogenically modified shocks and stresses diverge from earlier ecological and engineering modes
Table 7.1  Climate resilience issues and projected impacts in urban informal settlements

| Climate change hazards | City-scale vulnerability | Additional informal vulnerability factors |
|------------------------|--------------------------|--------------------------------------------|
| Higher (and increasing) average temperatures | General exposure to extreme heat and related heat stress, particularly for at-risk populations | Worsened localised heat impacts due to compact, poor quality built form, and a lack of utilities |
| Increasing rainfall variability and intensity, including extreme rainfall events | Stormwater infrastructure and water supply capacities limited to existing variability. Recurrent transport and services disruptions, localised damage | Impacts exacerbated due to a lack of regulatory compliance and formal drainage infrastructure. Proximity to informal water sources (rivers, springs, ocean) heightening exposure |
| Potable water quality and availability | Risk of utility shortfalls in supply, potable water importation needs, price spikes, and expensive infrastructure investment | Limited income capacity to pay for potable water price spikes, dependencies on variable informal water sources with additional risk of contamination |
| Sea level rise and coastal inundation (including extreme events, e.g. storm surges) | Demand for enhanced coastal defences, loss of previously insurable urban areas, long-term relocation strategies in conflict with local short-term interests and market structures | Limited options for retreat and reinforcement due to spatial and financial constraints, as well as a lack of state resourcing/subsidies. Tendency to be located in already at-risk areas, including intertidal zones. Lack of sanitation leading to secondary risks (e.g. disease) |
| Increasing frequency of more intense tropical cyclones/hurricanes | Building standards superseded by new return periods and intensities, heightened demand for state evacuation facilities, disruptions to urban food supplies | Direct dependency on localised food production with limited capacity to enter the cash economy. Poor quality/non-compliant housing construction. Frequent exclusion from evacuation and relief supply considerations |
| Ecosystem services deterioration | Increasing demand for imported goods and pressure on peri-urban surrounds | Widespread dependency on ecosystem services for primary or secondary income and subsistence |
| Climate-induced migration | Rapid urban growth risks outpacing development planning and government capacities | Heightened pressure on informal areas outside of government housing and land release programmes |

Adapted from: UN-Habitat (2018), Trundle et al. (2019), Moser and Satterthwaite (2010)
of resilience thinking (Holling 1996). Specifically, their focus on subjectively defined systems, and alternative transformations in system states, creates a normative resilience ‘vision’ that is open to contestation by constituent social groups and actors (Olsson et al. 2015).

Uptake of the resilience agenda in the Global South has been both triggered by climate-related shocks and through development practice (Leitner et al. 2018). For example, the Rockefeller Foundation’s Asian Cities Climate Change Resilience Network (ACCCRN) engaged ten Asian cities to build the ‘adaptive capacity of vulnerable urban populations’ (da Silva et al. 2012 p.127). Globally, within the 2030 Agenda for Sustainable Development, the 11th ‘urban’ Sustainable Development Goal aims to make cities ‘inclusive, safe, resilient and sustainable’ and includes a number of indicators and targets on resilient upgrading informal settlements (Griggs et al. 2013:16).

7.3 In-situ settlement upgrading

The contemporary upgrading model evolved from a trajectory of approaches over the past century. Informal settlements that proliferated in developing countries in the early twentieth century were seen in a negative light and government policy focused on eviction and eradication (Abrams 1966). By mid-century, large-scale, high-density housing projects aimed to replace slums with modernist housing; however, they could not meet demand and informal settlements continued to expand (Pugh 2001). A paradigm shift occurred in the late-1960s. Emphasis was given to the potential of the urban poor to meet their shelter needs through self-help, providing them the ‘freedom to build’ (Turner 1972). Meanwhile, informal settlements continued to expand due to supply, affordability, and location constraints of the ‘sites and services’ approach (Wakely 2018; Abbott 2002).

By the end of the twentieth century, in-situ (on site) upgrading of informal settlements had become mainstream. Informal communities were increasingly recognised as agents in upgrading decision-making, especially women and girls (Massey 2017). Community involvement improved project design, implementation, and increased the sustainability of interventions (Patel et al. 2001; French et al. 2019; Pugh 2001). In parallel, there was increased awareness of the importance of integrating urban planning and land management for the purposes of socio-spatial integration of informal settlements in their wider urban systems (French and Lalande 2013; UN-Habitat 2015).

Contemporary upgrading programmes include a standard suite of components (Table 7.2). Improving access to safe water and sanitation is often
| Component | Underlying logic and objectives | Examples | Relationship to climate resilience |
|-----------|---------------------------------|----------|-----------------------------------|
| Data and socio-spatial inclusion | Inclusion of settlements in urban plans and governance | Community-based enumerations | Accurate data upon which to design interventions and respond in crises |
| | Political recognition of residents and rights | Inclusion in government census | Capacity and awareness of climate hazards |
| | Identify local needs and deficiencies | Citizen science | |
| | | Spatial mapping of existing conditions and vulnerabilities | |
| Community participation | Plan with, not for residents | Form and/or strengthen existing community committees and groups | Build social resilience through collective action |
| | Build social capital | Capacity building of civil society groups | Identify and implement community-led adaptation actions |
| | Ensure diverse voices are heard | Set-up and/or strengthen governance forums for formal exchange and dialogue with authorities | Empower and provide space for the urban poor to engage in city and national resilience governance processes |
| | Ensure residents’ needs and priorities are reflected in upgrading actions | | Strengthen the social contract between citizens and the state |
| | Smooth implementation and promote ownership of interventions ‘Right to the city’ | | |
| Social support | Strengthen existing social capital | Youth and women’s groups | Build social resilience and adaptive capacity |
| | Improve livelihoods | Micro-finance and community-led savings groups | Foster local ownership and action |
| | Reduce conflict, crime and exclusion | | |
| Land tenure regularisation | Regularise settlement layout | Issue certificates of land occupancy (household and/or community) | Limit further informal land encroachment on hazardous land |
| | Increase security of tenure to foster a sense of ownership and inclusion | Issue land titles | Strengthen the asset base of urban poor |
| | Promote endogenous investment in housing improvements | Form community land trusts | Identification and safeguarding of public land for climate-responsive ecosystem services |
| | Increase local land-based revenues | Street addressing and house numbering | |
Table 7.2  (continued)

| Component                        | Underlying logic and objectives                                                                 | Examples                                                                 | Relationship to climate resilience                                                                 |
|----------------------------------|--------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
| Sanitation and water supply      | Improve human health, wellbeing, and dignity<br>Reduce burden of ill-health, especially on children and vulnerable groups<br>Improve productivity and reduced burden of poor water and sanitation, especially for women and girls | Centralised or decentralised wastewater treatment<br>Water supply through reticulated systems, wells, or others<br>Community-Led Total Sanitation (CLTS); faecal sludge removal; Water, Sanitation, and Hygiene (WASH) | Diversify water sources to strengthen resilience to droughts or extreme weather events<br>Reduce infrastructure operating vulnerability to climate change impacts |
| Urban services (i.e. electricity, transportation, solid waste collection, IT) | Extend urban services to improve amenity, mobility, and opportunity<br>Formalise services that are currently informal and/or illegal<br>Improve public health | Extend formal electricity and information technology networks<br>Municipal solid waste collection<br>Bus stops, cable cars | Strengthened resilience to adapt to climate change and severe weather events; better connection to formal services during extreme climatic events |
| Drainage and environmental improvements | Reduce ecosystem and environmental contamination<br>Reduce vulnerability to environmental effects such as flooding and storm surges<br>Improve public health | Stormwater drainage<br>Green spaces and tree planting<br>Flood mitigation infrastructure<br>Wetland and natural waterway restoration<br>Relocation of households occupying vulnerable land | Significant links between environmental improvements and strengthened climate resilience<br>Improved precinct and citywide resilience |
prioritised, having direct outcomes for resident health, wellbeing, and dignity. The paving of streets and laneways, along with urban ‘acupuncture’ in the form of public space interventions, is also widely deployed in tandem with stormwater management and drainage. Formalisation of services such as electricity, street lighting, and solid waste collection is also commonplace. Enhancement of tenure security through partial recognition and documentation of land or occupancy rights is also used to reduce the threat of eviction, exploitation, and corruption. This legitimisation also promotes endogenous local investment and provides the potential for leveraging local land-based revenues.

Climate resilience is increasingly being considered as part of upgrading processes to promote their integration with their local ecological and environmental conditions and accommodate projected climate change impacts (Zevenbergen et al. 2015; Satterthwaite et al. 2020). These additional considerations demand a ‘citywide’ approach to ensure that concepts such as vulnerability and climate change projections are applied consistently and efficiently (UN-Habitat 2015). The citywide approach

Table 7.2 (continued)

| Component                      | Underlying logic and objectives                                                                 | Examples                                                                 | Relationship to climate resilience                                      |
|--------------------------------|------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|--------------------------------------------------------------------------|
| Street, public space, and green infrastructure | Improve accessibility for residents and emergency services  
Improve amenity, safety, and security  
Reduce spatial segregation through integration with neighbouring areas  
Stimulate local economic development | Paving roads, streets, and pathways  
Installing street lighting  
Establishment or upgrading of public spaces such as sports areas, plazas, parks  
Public facilities such as libraries, service hubs | Reduced vulnerability to extreme weather events  
Emergency access in times of crises  
Increased green space reducing urban heat island effect |
| Housing rehabilitation       | Improve housing quality and amenity  
Reduce density and overcrowding | Promote incremental housing improvements  
Improved house services (e.g. clean cookstoves) | Green building design to reduce environmental impact  
Improved built environment resilience to shocks and hazards |

Adapted from: UN-Habitat (2014, 2015, 2018), Zevenbergen et al. (2015), Lucci et al. (2015), Cities Alliance (2020)
spatially documents all informal settlements within a city, understands the nature of spatial and socio-economic segregation and exposure to disasters and environmental risks, develops a citywide strategy/plan for upgrading, and establishes and implements local financial and institutional structures for delivery over an extended programme period.²

There is considerable variation in the arrangement of upgrading components across regions, countries, and cities. Satterthwaite et al. (2020) note upgrading projects can be seen as a continuum: a ‘ladder’, from ‘upgrading that is actually eviction’ to ‘transformative upgrading’ which is rooted in deep partnerships between authorities and communities where integrated, comprehensive, environmentally responsive upgrading occurs. There is significant variation across the world. Citywide upgrading is a standard part of government policy in Latin America and the Caribbean (Magalhães 2016). In contrast, upgrading has yet to become mainstream in Africa due to incipient urban and population growth, fiscal constraints, and the scale of urban informality (Bah et al. 2018; Gulyani and Bassett 2007). Community-led, urban acupuncture projects are common in Asia (e.g. Boonyabancha 2009). The Pacific presents unique conditions and responses given the interconnectivity between a diverse array of socio-cultural, spatial, and temporal urban migration patterns and the spatial typologies and climate vulnerabilities faced by Small Island Developing States (Jones 2016; McEvoy et al. 2020).

7.4 CLIMATE RESILIENCE CAPACITIES IN INFORMAL SETTLEMENT UPGRADING

The physical infrastructure components of slum upgrading can be understood as an attempt to increase the threshold capacity of settlement residents and their environments. Physical interventions, as outlined in Table 7.2, can help reduce vulnerability to the impacts of more intense precipitation, flooding, sea level rise, and coastal erosion, and can also

²The second important element of a citywide approach is increasing the supply of formal housing concurrently with citywide upgrading (Payne 2005). This recognises that to reduce the formation of new informal settlements, and to provide housing for informal settlement households who may be affected by upgrading interventions, the supply of new housing which is affordable to low-income households is an essential part of housing and upgrading policy. Brazil’s ‘My House, My Life’ programme is a notable example: UN-Habitat (2013) Scaling-up affordable housing supply in Brazil: The ‘My House, My Life’ program. United Nations Human Settlements Program: Nairobi.
reduce their vulnerability to the long-term effects of climate change such as increased water scarcity, urban heat island effects, and disease vectors. Likewise, intangible upgrading components, as outlined in Table 7.2, can also be important levers to increase threshold capacity. Land regularisation and tenure security, data and mapping of settlements, and community participation and citizen engagement can be fundamental components of strengthening climate resilience.

The underlying assumption embedded in current upgrading policy and practice is that investments in urban infrastructure (threshold capacity) contribute to improved coping capacity and recovery capacity. When designed, implemented, and managed well, physical upgrading interventions can help to reduce damage during extreme weather events in informal settlements, and help households and informal communities to recover more effectively. Land tenure regularisation is an important factor in increasing the coping and recovery capacity of households (Unger et al. 2017). Likewise, actions to increase the social and institutional threshold capacity of communities can pay dividends for coping during disasters and extreme weather events, and for recovering from them, especially when processes and response structures build on the ingenuity and creativity of residents and where humanitarian assistance builds on ongoing urban resilience efforts rather than undermines them.

While adaptive capacity is increasingly considered in settlement upgrading, it has yet to become mainstream. It is operationalised to ensure that investments in the physical upgrading of streets, stormwater drainage, and water and sanitation will be sustainable in the face of medium- and long-term environmental change, notably rising sea levels, increased ambient temperature, precipitation, and more frequent extreme weather events. Climate resilient technological interventions are increasingly being considered, for example rainwater harvesting to diversity water sources, on-site sanitation systems that are less vulnerable to trunk infrastructure outages, and natural filtration of stormwater to reduce contamination of ecosystems (Brown et al. 2018). However, these are not commonplace in upgrading practice, and there remains very little leapfrogging to climate-adaptive approaches.

In coastal areas, the most significant adaptive capacity demand is to respond to rising sea levels and flooding. In the face of these interconnected threats and associated extreme weather events, ‘managed retreat – the relocation of homes and infrastructure under threat from coastal flooding – is one of the few policy options available’ (Tadgell et al. 2018:102). This is exacerbated by the limited funding available for in-situ
adaptive upgrading relative to the scale of and continued growth in informality in the Global South. Relocation, however, is immensely problematic. Johnson (2020) argues that relocation is a flawed response and often equates to forced eviction. Relocation is expensive; Governments in the Global South have insufficient fiscal capacity to provide safe alternatives commensurate with demand. When alternative housing can be provided, it is often poorly located vis-a-vis livelihood opportunities; does not match the needs, priorities, and fiscal capacity of the intended beneficiaries; and the relocation disrupts existing social support systems.3 Relocation projects are seldom framed in terms of long-term development action for affected communities, but rather short-term risk reduction measures which limit their effectiveness (Johnson 2020). Low-income households and communities have considerable formal and informal existing assets that can be harnessed for endogenous adaptive responses (Moser and Satterthwaite 2010), yet such an asset-based framework is often ignored to justify relocation. Overall, because relocation is so complex and returns policy and practice to a previously failed approach to addressing informal settlements, relocation as an adaptive action is not commonplace.

7.5 Transformative Informal Capacities: Elements of a Holistic Approach to Urban Climate Resilience

The first four capacities—threshold, coping, recovery, and adaptive—are alone unlikely to meet the scale of climate challenges faced by coastal informal settlements. Instead, the resilience of urban areas to the impacts of climate change hinges most critically on building the fifth ‘transformational capacity’ proposed by Ovink (Ovink, H. Personal communication, 22 February 2019). This conceptual division provides a useful tool to explore how a step change in policy and practice responses to informal settlements might be advanced. Many of the elements of transformative capacity discussed in Table 1.1 in Chap. 1 are relevant for informal settlements in the Global South. For example, proactive and inclusive planning and design with all stakeholders, linking water issues to urban dynamics, can provide a framework for moving from single projects to integrating innovative processes through the enhancement and participatory inclusion of local capacities.

3 While there are unique cases of relatively successful relocation (e.g. Cronin and Guthrie 2011), these are the exceptions rather than the norm.
In addition, there are specificities related to the Global South context that deserve detailed interrogation and critical reflection. These include extreme poverty, socio-economic exclusion, food insecurity, protracted conflict, entrenched gender inequalities, nebulous land and housing rights, corruption, weak governance and institutions, and, importantly, the rapid pace of urbanisation and population growth (Pieterse 2011). As Friend and Moench observe, these urban systems ‘are emergent mosaics … which reflect social values and relations, coupled with the coevolving environmental and infrastructure systems’ (2015, p. 646). High level of informality is a dominant feature of these mosaics that cannot simply be ignored, overridden, or undermined by formal approaches. Therefore, framing climate resilience as an optional ‘add-on’ to informal settlement upgrading in the Global South is unlikely to produce the transformative capacity that is needed at a city scale.

We argue that five elements are needed to underpin climate-resilient transformative capacity building that integrates the informal domain. These five elements are not exhaustive, nor are they independent of each other. They build on informal settlement upgrading theory, policy, and practice with a critical view towards a greater ambition to achieve transformation.

The first element is socio-technical innovation. Physical upgrading projects too often rely on conventional approaches to engineering infrastructure and services, for example centralised trunk infrastructure systems for water and sanitation provision. These require significant capital investment, have high embodied energy, and require fossil fuel for their operation and maintenance. Innovative twenty-first century technologies and infrastructure approaches can help ‘leapfrog’ to more sustainable urban infrastructures that can better respond to local conditions and work with nature and local environmental systems and processes to deliver services in harmony with the environment and climatic changes. Infrastructure innovations can reduce the ‘lock-in’ to environmentally intensive infrastructures and, when well designed, can be more resilient to local shocks (Brown et al. 2018). Importantly, it demands a socio-technical approach that reframes the relationship between social systems and technical engineering components. A socio-technical approach focuses on the interaction of people and their environment, for example environmental exposure pathways affecting human health in informal settlements, to achieve mutual benefit for people as well as the environment.4

4The Revitalising Informal Settlements and their Environments (RISE) programme is an example of leapfrogging informal settlement water and sanitation infrastructure to more environmentally sustainable socio-technical approaches. See: www.rise-program.org and Brown et al. (2018).
Linked with socio-technical innovation is **climate justice**, the second element for building transformative capacities. By reframing climate change from a predominantly environmental or physical phenomenon towards one that is inherently social, ethical, and political, the severe inequalities and human rights violations that underpin socio-spatial exclusion and vulnerability are brought to the fore. Too often climate resilience policy and practice ‘lacks a normative focus on advancing the needs of the most marginalised and most vulnerable’ (Bartlett and Satterthwaite 2016:25). Likewise, practice-driven considerations of resilience through donor-developed frameworks and mechanisms do not always engage sufficiently with the theoretical principles and the term’s conceptual strengths (Sharifi 2016). An explicit climate justice framing can give due recognition that disadvantaged groups, such as those occupying coastal informal settlements, are on the frontlines of the fight against climate change impacts and suffer grave inequalities and political and socio-economic exclusion that exacerbates their vulnerability. Ziervogel et al., for example, provide four ‘entry points’ for a justice- and rights-based resilience agenda, which stem from the recognition of the endogenous resilience qualities and capacities that can exist outside of—and be in conflict with—the institutional regime-level functions that are empowered at a city-scale (2017).

Third, a climate justice framing encourages greater attention be paid to the **intersectional dimensions** and diversity of lived experiences of informal settlement residents and groups. Intersectionality is a framework for understanding how combinations of vulnerabilities, injustices, and discrimination (i.e. gender, class, race, sexuality, age, ability, poverty, etc.) are manifested and experienced differently by different groups ‘due to their situatedness in power structures based on context-specific and dynamic social categorisations’ (Kaijser and Kronsell 2014; Grünenfelder and Schurr 2015). Evidence across a variety of contexts shows that women, girls, sexual minorities, and less able people living in informal settlements suffer specific and compounding marginalities and vulnerabilities, and suffer disproportionately from the effects of poor informal settlement services and conditions (Castán Broto and Neves Alves 2018). A climate justice and intersectional framing therefore demands ‘a drastic shift in existing power structures and the policies these structures bring forward, a shift that puts the needs of the poor high on the agenda’ (Roy et al. 2016:6).

Fourth, **inclusive governance and community empowerment** are crucial underpinnings of transformational capacity. Informal settlement residents and organised community groups should be meaningfully
empowered to play a role in the decisions affecting their lives and neigbourhoods. The enormous social capital that exists in informal settlements cannot be underestimated and can be a powerful force for transformation (Satterthwaite et al. 2020; Archer 2016). Community empowerment alone, however, is insufficient for transformation, and a significant strengthening of urban governance is needed. Urban governance institutions in the Global South are poorly resourced, overburdened, and have limited capacity to inclusively plan and manage urban development processes. Aid and donor investments can further undermine the endogenous capacity and functioning of state and city authorities, especially in countries highly dependent on foreign aid (French et al. 2019).

A more flexible framing of urban governance and community engagement as they relate to climate resilience is advantageous. Harris et al. (2018) argue that too often the climate resilience agenda is premised on notions of ‘win-win’ end-state situations rather than seen as highly political, complex, and dynamic processes (Mikulewicz 2019). Coined ‘negotiated resilience’, ‘by foregrounding the procedures and processes of resilience, we can better attend to the politics and stakes of negotiation — i.e., whose interests are advanced in what way and with what possible outcomes, as well as how ideals of consensus or policy agendas are actively sought, managed, and at times produced’ (Harris et al. 2018:196). Helmke and Levitsky’s typology of informal–formal interactions provides a useful framework for considering the compatibility of informal and formal functional values relative to the existing effectiveness of urban governance (2004). Applications to informal settlements focused on endogenous climate resilience capacities highlight the importance of such an approach, drawing out areas where informality is providing supportive substitutive urban functions, and others where competing values require negotiation (Trundle 2020).

In practice, this means asking capacity and resilience for whom and for what, as well as where, when, and why (Meerow and Newell 2019). This is particularly important in the Global South given the complexity of decision-making, with the allocation of scarce resilience resources competing against demands for poverty reduction (Friend and Moench 2013), the prevalence of corruption and elite capture (Berquist et al. 2015), and the additional agendas and conditions attached to large volumes of sustainable urban development funding (Mikulewicz 2019). These considerations are widely recognised in urban development literature as structurally constraining the capacity to respond in humanitarian crises and socio-spatial injustices stemming from historic
and contemporary urban growth patterns (Dodman et al. 2013; Borie et al. 2019). However, they have had less attention within the conceptual frameworks deployed in the practice of urban climate resilience.

The fifth element is **fit-for-purpose finance**. This recognises that achieving a transformation in informal settlement upgrading requires significantly increased levels of finance compared with previous and current levels, and requires new financial modalities and instruments underpinned by climate justice framing (UN-Habitat 2018). Transformation efforts should amplify the plethora of ‘bottom-up’, community-led financing initiatives for settlement upgrading projects that have proliferated over the past two decades (Archer 2012). Community-based finance is premised on the power of collective self-help and support at the local level, and seeing finance as an essential part of building the transformative capacity of the urban poor.5

While community-based finance is an important mechanism, it has had limited success in accessing international climate finance (i.e. the Green Climate Fund (GCF) and Global Environment Facility (GEF)). Colenbrander et al. (2018:902) argue that ‘adaptation finance is primarily allocated to multilateral entities and national governments, rather than local organizations. This means that the social, political and economic processes that create and sustain inequalities within a country will be the same processes that determine how adaptation finance is used’.6 Similarly, Overseas Development Assistance (ODA) and well-intentioned philanthropy-backed initiatives are too-often premised on short-term, project-based action which cannot foster transformational change for climate resilience, especially at city and community levels (Ayers 2009). ‘Fit-for-purpose’ financing, therefore, must include expanded access to climate finance by local governments (e.g. municipalities) and community groups to fund climate resilience processes, not projects (Funder et al. 2015) (Table 7.3).

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5 For example, community-development funds (CDFs) initiated by the Asian Coalition for Community Action provide funding to informal settlement community groups across more than 100 cities (Archer 2012). Similarly, the Community-Led Infrastructure Finance Facility (CLIFF) provides capacity grants and revolving capital funds to non-profit and community groups to make investments in housing and upgrading (McLeod and Mullard 2006; World Habitat 2020).

6 For example, based on empirical case study research in Malawi, Barrett (2014) demonstrates a stark mismatch; the areas most in need received relatively little finance, and therefore the ‘distribution of adaptation funds do not support the larger goal of climate justice’.
Table 7.3  Assessment of prevailing upgrading components and climate resilience measures against the five capacities framework

| Components of upgrading | Threshold capacity (prepare and prevent damage resulting from environmental variation) | Coping capacity (reduce damage during extreme weather events) | Recovery capacity (recover effectively after disasters) | Adaptive capacity (adapt to current and expected environmental trends) | Transformative capacity (to transition proactively to a climate-resilient society) |
|-------------------------|------------------------------------------------------------------------------------------|---------------------------------------------------------------|--------------------------------------------------------|---------------------------------------------------------------------|--------------------------------------------------------------------------------|
| Data and socio-spatial inclusion | Baseline and vulnerability assessments; Data informs preparations and prevention actions | Authorities know about settlements and their populations and can respond | Pre-disaster/ event data available for recovery and rebuilding | Data can inform upgrading projects to adapt to anticipated trends | Data could be used for (citywide) transformation, but often is not |
| Community participation and social support | Communities mobilised to prepare and prevent damage; City plans incorporate the urban poor; early warning systems | Crisis plans; Community support networks respond; mutual self-help | Community support networks to recover; humanitarian assistance; mutual self-help | Communities often have more immediate needs that become focus of today’s efforts | Values misalignment; Urban poor not included in citywide risk resilience governance processes |
| Land tenure regularisation | Land regularisation can foster/increase mitigation investments | Land tenure clarity can reduce conflict during events | Strengthened land rights enables faster recovery; reduced conflict | Land regularisation in hazardous sites in conflict with long-term adaptation; | Clear land rights is a prerequisite for transformation, but not seen through a climate lens |

(continued)
Table 7.3 (continued)

| Components of upgrading | Threshold capacity (prepare and prevent damage resulting from environmental variation) | Coping capacity (reduce damage during extreme weather events) | Recovery capacity (recover effectively after disasters) | Adaptive capacity (adapt to current and expected environmental trends) | Transformative capacity (to transition proactively to a climate-resilient society) |
|-------------------------|----------------------------------------------------------------------------------------|---------------------------------------------------------------|-----------------------------------------------------|-------------------------------------------------------------------------|--------------------------------------------------------------------------------|
| Sanitation and water supply | Increased diversity of water sources; reduced environmental contamination | Reduced vulnerability to public health impacts | Quicker and safer recovery; Water, Sanitation and Hygiene (WASH) projects | Diversity and resilience water and sanitation possible but not commonplace; little leapfrogging | Interventions are largely delivered using old methods; little ‘leapfrogging’ |
| Street and public space infrastructure; Drainage and environmental improvement; Urban services | Improves access and can minimise climate change and disaster impacts; Greatly strengthens urban resilience | Settlements with upgraded physical infrastructure far better placed to cope during | If built well, provides a good foundation to rebuild and recover | Innovative adaptive approaches possible but not commonplace; often exacerbate potential impacts | Limited. Actions rely on traditional approaches |
| Housing improvements | Limited action in current upgrading efforts | Limited action in current upgrading efforts | ‘Build back better’ agenda. Limited recovery effort for housing - mostly occupant-led. | Very limited practical action in urban informal settlements | Very limited practical action in urban informal settlements |

Source: Author’s compilation
7.6 Conclusion

This chapter used the ‘five capacities’ framework as a tool to examine climate resilience of in-situ informal settlement upgrading to draw novel theoretical and conceptual insights. It contributes to a critique of prevailing climate resilience approaches that centre on simplistic threshold, coping, recovery, and adaptive capacities. These appear insufficient to make a meaningful and significant change given the scale of the challenge with one billion people living in informal settlements today, and the fact that these first four capacities cannot overcome the entrenched structural inequalities and deep socio-spatial injustices shaping cities in the Global South.

The fifth capacity, transformative capacity, offers an opportune pathway that may foster more significant material improvements in the human health of informal settlement residents and mitigate the impacts of climate change at a level commensurate with the scale and urgency of the challenge. For transformative capacity, the chapter identified five transformational elements for informal settlement upgrading theory and praxis: socio-technical innovation; a climate justice framing; greater attention to intersectional dimensions; inclusive governance and community empowerment; and fit for purpose finance. This is reflective of a broader need for climate change responses and projects to reform the prevailing models of urban development in the Global South, which perpetuate structural inequalities and unsustainable urban development practices.

This chapter aligns with other critiques of the normative framing of resilience, particularly in dynamic and contested cities of the Global South. Central to these critiques is a lack of theoretical and practical mechanisms for understanding and addressing divergent normative viewpoints and values (Davoudi et al. 2012). As outlined, we have argued that any such consideration implicitly requires a more explicit framing in terms of fundamental social attributes such as equity and justice (Chelleri et al. 2015; Ziervogel et al. 2017; Trundle 2020). By operationalising resilience through a climate justice lens and building on existing approaches to upgrading practice, we demonstrate that informal settlements, exemplars of urban subsystems with divergent functions and values, could be transformed as part of efforts to generate climate resilient urban areas in coastal and delta cities.
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