



Co-producing urban resilience solutions

The role of power and politics

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Enhancing urban resilience to climate change is a complex problem. Top-down, linear design, implementation and monitoring programmes are not sufficient. Instead, interventions that work with civil society organisations, policymakers and academics in the co-production of more inclusive representations of urban risk and resilience priorities can more effectively influence decision making. However, for co-production interventions to be impactful they must be sensitive to the power relations that drive urbanisation and climate risk. This paper offers a framework to inform the design of co-production interventions through an understanding of context-specific politics and power.

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Summary

Most of the world's population is now urban, with towns and cities disproportionately located along coasts and rivers. These urban centres, which are home to vast numbers of poor and vulnerable people, are on the frontline of climate risk. Therefore, enhancing their resilience is an urgent priority. However, this is a complex problem.

Enhancing the climate resilience of urban areas is difficult — if not impossible — through traditional linear, top-down planning, implementation and monitoring approaches. This is largely due to the need to consider what resilience to climate extremes and stresses means to the many different groups living within a town or city. 'Co-production' is the answer.

Co-production seeks to explore and reframe complex problems by encouraging an open dialogue and knowledge sharing between different communities of practice, policy circles and research groups. By considering multiple and diverse perspectives, it looks for creative solutions. Co-production seeks to flatten power relations between participants.

However, some argue that it is not clear how best to deploy the large variety of methodological approaches to operationalise co-production. Others express concerns about the risk of exacerbating inequalities in planning processes when implementing naïve co-production interventions, or interventions that fail to consider the power relations underpinning the governance structures they hope to influence.

This paper presents a strategic approach to using co-production to unearth effective, contextual solutions for urban resilience. It explains how understanding the institutional and knowledge context of a city reveals key 'orientations' or the 'types of change' that co-production processes should adopt across different areas of urban resilience action.

For co-production, the 'context' of an urban centre can be explained through four analytical dimensions:

1. **Organisations:** the organisations that structure and lead decision making, determine how funds are spent; where data is collected, analyses performed, and findings produced.
2. **Practices, norms and legitimacy:** the systematic ways of 'generating' and 'validating' knowledge, and the conditions under which certain types of knowledge gain influence.
3. **Knowledge and resource flows:** risk information, data, and more generally knowledge circulate between organisations, influencing decision-making processes, such as planning and budgeting.
4. **Networks:** Finally, it is important to understand how networks of likeminded individuals, such as communities of practice, operate to allow for new visions of the future, for novel urban resilient futures.

Effectively mapping the knowledge and institutional context will allow those leading co-production to determine the most effective course of action. Co-production approaches can focus on **changing the behaviour** of individuals and communities, to deal with the problem at hand. Alternatively, they may look at a more radical vision of change by seeking to **empower marginalised groups** to confront the structural causes of their vulnerability. Co-production may aim to **'broker agreements'** between different groups or individuals to temporarily tackle risk. For example, by agreeing to new rules on the more equitable use of critical resources such as water. Alternatively, they may aim to **enable systems change** where, for example, more equitable resource use is enshrined in the law or government protocols. Finally, the context could also determine how 'open' or 'closed' co-production processes will be. In certain contexts, co-production may only be able to **solve problems identified** prior to the co-production process. In others, they may **(re)frame a problem**, facilitating a shift in how different groups perceive an issue. The framework does not posit these as 'binaries' but urges the user to conceptualise these as axes or spectrums of the possible changes that co-production processes may deliver. This in turn enables those leading co-production to be more strategic.

Along with effectively determining the orientation for co-production based on an accurate understanding of the context, the framework then presents five 'domains of action' for urban resilience. The framework contends that urban resilience co-production initiatives can aim to either enhance community assets and services (including community food production, housing, basic services, including health provision, income and social capital); enhance knowledge and awareness (spanning innovations in acquiring and analysing data on risk and providing information on potential hazards); governance, management and other aspects of decision-making (involving actions that handle, direct, govern, or control aspects of human hazard interaction); develop grey or

green infrastructure (either by enhancing the resilience of planned infrastructure or developing infrastructure to mitigate risk); or helping cities and urban populations secure financial resources for enhancing resilience. In essence, each of these domains acts as an 'entry point' for particular orientations of co-production.

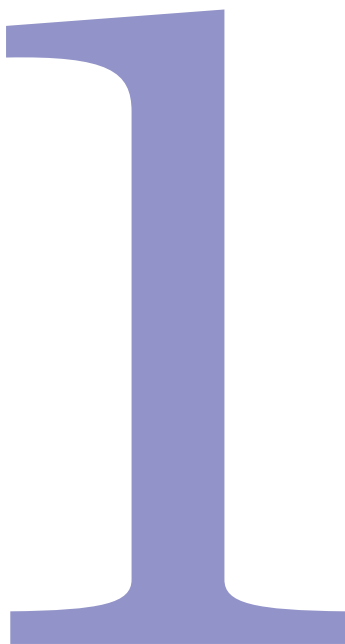
Finally, the paper concludes by proposing a set of rules for effective co-production. These include:

- the need to think strategically about who is included within processes of co-production (broad participation might lead to patchy engagement or conversely, being too selective might lead to loss of faith in the process);
- to engage across scales (this would entail ensuring that co-creation processes include people from higher scales of governance);

- to collectively determine the rules and norms of the co-production processes (as externally-imposed rules might lead to a loss of trust in the process);
- ensuring transparent communication and participation on equal terms between participants that might occupy different positions in a city's socio-economic hierarchy;
- and balancing rationalist methods with those that use emotion to create a connection between individuals.

In this way, the paper presents a credible and evidence-based pathway for the strategic co-creation of contextually-relevant and effective urban resilience solutions. This is to ensure vulnerable populations in marginalised urban contexts not only function, but flourish, despite climate-induced shocks and stresses.

Introduction



Enhancing urban resilience is a complex problem (Maslow, 1943; Valdivia, 2018; Williams, 2005). It is difficult — if not impossible — through traditional linear, top-down planning, implementation and monitoring approaches (Dorst et al., 2016; Lang et al., 2012). This is largely due to the need to consider what resilience to climate extremes and stresses means to the many different groups living within a town or city. This implies conflicting and changing orientations towards the problem, and hence preferred solutions to urban resilience (Arnstein, 1969; Folke et al., 2005). Moreover, dominant framings and solutions tend to exclude a wide spectrum of alternative options to tackle climate uncertainty and urban complexity, reproducing the ‘root-causes’ of vulnerability (Turnhout et al., 2020). This paper invites project teams to refocus their attention on urban (risk) governance processes, looking at how power and politics shape planning processes and how social learning takes place (Collins and Ison, 2009).

Co-production is an approach that has gained momentum in climate change, development planning, sustainability, collaborative governance, social learning, and participatory action-research, which offers an avenue to respond to these challenges (Wyborn et al., 2019; Verschuere et al., 2012; Miller and Wyborn, 2018; Bremer and Meisch, 2017; Clark et al., 2016; Chen et al., 2011). Co-production seeks to explore and reframe complex problems by encouraging an open dialogue and knowledge sharing between different communities of practice, policy circles and research groups. By considering multiple and diverse perspectives on a problem, it looks for creative solutions. Co-production seeks to flatten power relations between participants, often derived from their legitimacy to discuss the problem at hand (Folke et al., 2005; Ahern, 2011; Goldstein, 2009; Desouza and Flanery, 2013).

Despite a general acknowledgment that co-production has the potential to contribute to inclusive governance and urban resilience, there are also critical voices. Some argue that it is not clear how best to deploy the large variety of methodological approaches to operationalise co-production (Wyborn et al., 2019; Lemos et al., 2018; Norström et al., 2020). Others express concerns about the risk of exacerbating inequalities in planning processes when implementing naïve co-production interventions, or interventions that fail to consider the power imbalances underpinning the governance structures they aim to influence (Lemos et al., 2018; Musch and von Streit, 2020; Turnhout et al., 2020; Järvi et al., 2018).

This paper responds to these challenges by developing a design framework for co-production interventions in urban resilience that focuses on power and politics. Approaching urban resilience through a co-production framework that is sensitive to power enables us to understand how risk knowledge production interacts with city decision making. It also means being strategic about how to influence these processes, which will often have political implications, or implications that some city groups will pursue, and others will resist. This framework therefore helps practitioners and policymakers to understand the power landscape of cities, tactically engage with them and ultimately evaluate the extent to which their actions have influenced them.

The paper draws on a range of literature. Firstly, on citizen participation (Brandt and Svendsen, 2013; Collins and Ison, 2009; Tritter and McCallum, 2006; Ross et al., 2002), social learning (Boonstra and Boelens, 2011; Foster, 2011; Ostrom, 1990; Aarts and Leeuwis, 2010; Bovaird, 2007), and Sustainability Studies (Van Kerkhoff and Lebel, 2015; Muñoz-Erickson, 2014; Wyborn, 2015), to offer guidance and good practice for the deployment of co-production interventions. However, these bodies of work do not wholly explore the issue of power and politics, risking the roll-out of naïve co-production interventions that exacerbate marginalisation and vulnerability. To overcome this limitation, the paper draws on Science and Technologies Studies (STS) (Jasanoff, 2004; Muñoz-Erickson et al., 2017) to offer a power sensitive context analysis.

The paper is structured as follows. Section 2 offers a framework to understand how decision making and knowledge production institutions interact in cities. This allows co-production interventions to strategically integrate the risk knowledge and experience of marginalised residents in planning processes. Section 3 offers three orientations to guide the deployment of co-production interventions. Section 4 grounds the paper empirically and presents a number of co-production interventions, demonstrating how they interact with insights in section 2 and 3. Section 5 concludes with good practices for implementing organisations to gain and maintain recognition and influence — a vital consideration during co-production interventions.

The paper is an ‘input’ into a process commissioned by the Adaptation Research Alliance to collaboratively identify innovative methods, processes and pathways for urban resilience.

Knowledge and decision-making institutions



Knowledge production cannot be understood as external to decision making (Jasanoff, 2004). Power and knowledge are mutually constitutive, conferring one another authority, legitimacy and credibility. Contrary to the prevalent belief that knowledge can be objective and politically neutral, Science and Technology Studies have taught us that there is no institution dedicated to producing knowledge or policy-oriented evidence that can claim to be independent from the decision-making institutions dominating the field within which they operate.

This framing is helpful to explain how knowledge co-production interventions for urban resilience interact with knowledge and decision-making processes. Some interventions seek to transform governance structures and policy processes, reframing relationships between powerful and vulnerable groups, to ensure more resilient futures. Consequently, these interventions bear politically progressive visions and as such, tend to come up against city actors and groups who would not benefit from a just redistribution of opportunities, risk and privilege. Resistance may also emerge from entrenched ways of doing things. For example, through planning processes that systematically ignore the risk experience of certain groups and place the burden of adaptation on them. Similarly, reputable institutions and professionals dedicated to gathering evidence may be reluctant to review their practices and methods. They may inadvertently obscure the risk experience of some while overemphasizing opportunities to mitigate risk for others.

Politically progressive co-production interventions must be strategic if they are to overcome these resistances and entrenched ways of making decisions and understanding risk, that naively disregard the experiences of the most vulnerable groups. Here, being strategic starts by 'knowing how the city thinks' (Muñoz-Erickson et al., 2017) to find ways to influence and transform how knowledge and decision making influence each other. In the context of urban resilience, knowing how cities think refers to exploring how different groups invest with meaning their visions for the future, whether economic (de-)growth, sustainable development, or resilience, among others. It also implies understanding how knowledge and scientific practices become recognised and credible to guide how best to mitigate and adapt to a changing climate. Similarly, it means investigating how decision-making practices reinforce dominant scientific knowledge, reproducing risk perspectives that make invisible the vulnerability of some. Knowledge production and decision-making institutions, such as municipal governments, research councils and think tanks, form relatively stable regimes linking (public) funding, scientific authority and government legitimacy.

Understanding power-knowledge regimes is arguably a necessary precondition to influence adaptation and development pathways through co-production interventions. The context of a City, as a power-knowledge regime, can be broken down into the following constituent elements.

- **Organisations:** the organisations that formulate the questions and problems that inform decision making and funding allocations; where data is collected, analyses performed, and findings produced. It also refers to the sites and organisation where visions for the future, such as economic development, sustainability and resilience, are generated. Lastly, it means mapping the organisations with the legitimacy to produce risk knowledge, such as climate projections and vulnerability assessments; and those organisations sensitive to these analyses (Boykoff, 2009).
- **Practices, norms and legitimacy:** defines the systematic ways of generating and validating knowledge, and the conditions for knowledge circulation and influence in a city (Miller and Muñoz-Erickson, 2017; Miller et al., 2010). For knowledge to be credible, and therefore able to influence decision making, its production must comply with a number of norms and expectations, including methodological designs, alignment with relevant policy issues, and limitations on which institutions can be implicated in its production. Furthermore, institutions capable of complying with orthodox practice renew their credibility, further closing the space of influence for others deploying different methodologies. In the context of urban resilience, we may ask how risk is characterised, how risk assessments are generated, and what are the implications for the risk that is, and is not visualised. We would ask who is involved in this process and how their involvement limits the credibility and influence of organisations with different perspectives.
- **Flows:** refers to the circulation and exchange of knowledge and resources that connect knowledge production and decision-making institutions in a city, allowing them to continue their practices and renew their credibility (Kaika, 2005; Peck, 2011; Temenos and McCann, 2013). This also confers stability to a city as a power-knowledge regime, which ultimately restricts the possibility of redressing power imbalances. In the context of urban resilience, this could consider how risk-knowledge objects, such as climate projections and risk maps, circulate between institutions, influencing decision-making practices such as planning and budgeting. This will in turn explain how knowledge circulation influence other city flows, such as public funding, private investment, and the provision of services and commodities, which are significant for urban resilience.

- **Networks:** while deploying co-production interventions for urban resilience, practitioners would be interested in the conditions that may open space for the emergence of a new power-knowledge regime. Large-scale disasters have been shown to exert a polarising effect over civil society organisations and vulnerable groups, catalysing political, policy and institutional change (Pelling and Dill, 2010). During these windows of opportunity, the institutional landscape of a regime becomes more fluid, which means that the norms and practices that regulate exchanges of knowledge and resources between organisations become relatively less rigid (Pelling and Manuel-Navarrete, 2011). Networks of likeminded individuals, such as communities of practice, enter into power struggles that can spark transformative change (Pelling et al., 2008), including questioning the legitimacy of well-established organisations and practices.

Orienting co-production interventions: a typology of design options

3

This section offers a design framework to orient co-production interventions when they seek to influence power relations. This framework can be used as a design tool for researchers, practitioners and policymakers, while aiming to influence power-knowledge regimes as discussed in Section 2. It offers three axes, including the way an intervention a) is oriented towards vulnerable groups; b) is oriented towards powerful actors and systemic structures, and c) how it engages stakeholders while shaping its aims and objectives. Each axis should be understood as a spectrum of options moving from one pole to the other, instead of a binary choice between them.

Axis 1: Orientations towards vulnerable groups

Co-production approaches can be found along an axis that defines their orientation towards the most vulnerable groups (van der Hel, 2016; Harvey et al., 2019; Lövbrand, 2011):

- **Behavioural change:** a focus on changing the behaviour of individuals and communities, to deal with the problem at hand and improve the situation. This may be encouraging slum dwellers to develop neighbourhood disaster risk reduction plans and ultimately mobilise community resources to fund some of these activities. Other interventions may seek to encourage the adoption of nutrition and sanitation practices among community members, to enhance their health and ultimately household resilience.
- **Empowerment:** seeking to empower marginalised groups so they can better confront the structural causes underpinning their vulnerability. This may be by providing scientific evidence to legitimise their claims (Cockburn et al., 2016). Here, community meetings could be held to develop the disaster risk reduction plans discussed above, with the intention of creating a safe space and connections among households within a community. Ultimately, this intervention may seek to strengthen a sense of community, addressing internal conflicts, and thereby enhancing its ability to negotiate with city stakeholders. While the convening reason in both cases is the same — developing disaster risk reduction plans — the intention differs.

From a conceptual perspective, a **behavioural change** approach sees vulnerable groups as responsible for managing the risk affecting them, therefore seeking to enhance their capacity to deal with it. In contrast, an **empowerment approach** attributes the generation of this risk to systemic structures, such as the land economy and city governance. Therefore, it focuses on enhancing the ability of vulnerable groups to transform these very structures as a way to avoid the production of risk in the first place. This is not to say that every

intervention that claims to seek the empowerment of vulnerable groups should fall into these categories. Instead, it demonstrates how one intervention can be deployed in relation to the agency of the most vulnerable groups.

An approach that focuses on **empowerment** must be careful not to see community involvement as a panacea. It is particularly effective when combined with social learning, capacity building, and building institutions to further multi-scalar partnerships (see section 5). An emphasis on empowerment however can also result in the confrontation of powerful actors, which may hinder change.

Axis 2: Orientations towards powerful groups.

Co-production approaches can also be designed along an axis that defines their orientation towards powerful actors and systemic structures (Cockburn et al., 2018; Turnhout et al., 2020; Avelino, 2017):

- **Brokering agreements:** the aim to influence powerful actors, such as policymakers or corporate executives, ultimately encouraging them to hand over power and privilege. For example, initiatives that bring together government officials and the private sector to adopt pro-poor policy and corporate social responsibility in the development of social housing. While these agreements may result in advantages for vulnerable groups, powerful actors will also seek to benefit.
- **Systems re-structuring:** to open up the constraints imposed by systemic structures, such as the economy, governance institutions, policies and planning processes. For example, by embedding innovative planning processes that integrate the priorities of at-risk groups. This works by fostering the recognition of risk modelling approaches that emphasise the risk of marginalised groups and their subsequent integration into urban development planning.

Brokering agreements tends to focus on creating a safe space, through trusted brokers able to ease emerging conflicts. Tracking progress throughout and balancing the use of the language of different powerful actors encourages sustained participation. A limited success in the institutionalisation of these agreements is expected, because of the difficulties resulting from building long-lasting trust between diverse actors. This approach risks disempowering marginalised groups, particularly when deployed without an intimate understanding of the local power dynamics. By giving powerful actors scientific evidence, this type of intervention may legitimise their preferences and agreements.

In contrast, **system re-structuring** aims to transform institutions, policies, planning processes and visions of what counts as a desirable future. Working at a systemic level, this type of intervention can have sustainable impacts, replicated at lower scales. Where there are existing multi-scalar networks that can be mobilised and long-standing institutional arrangements, this mode has better chances of achieving impact (Christie et al., 2017; van Kerkhof et al., 2019).

Axis 3: Defining problems and solutions: a spectrum of participation

Co-production approaches can be designed along an axis depending on how open interventions are to collaborative problem solving:

- **Pre-identified problems and solutions:** some interventions aim to find a solution to problems identified prior to the co-productive process. Participants here are engaged to reflect on the context of the problem and its possible solutions. For instance, in some cases municipalities and international donors have focused on flood exposure in informal settlements. While some approaches could tackle the issue of flood exposure in informal settlements, others promote neighbourhood upgrading combined with selective evictions and relocations, community financial investments and land tenure recognition. Here, communities are engaged to agree on a neighbourhood plan that fits with municipal regulations, and to encourage the acceptance of voluntary relocation.
- **(Re)framing problems:** some interventions pursue the (re)framing of a problem, helping to shift the perception and orientations of different groups towards the issue. Working with a range of stakeholders, researchers and practitioners deploy various methodologies to reframe conflicts that stifle collective action. Boundary objects, such as scientific models, scenarios, and serious games, are used as methodologies to find common ground (Filippi et al., 2023). Following with the previous example, some interventions have opened the discussion beyond flood exposure, finding that communities emphasise socio-economic vulnerability instead. In these cases, economic opportunities, such as proximity to work sites, and community support, are deemed the main incentives for living in highly exposed city neighbourhoods. This invites government officials and donors to approach the issue of floods differently, considering social security mechanisms.

In the case of **pre-identified problems and solutions**, co-production interventions hold a tight control on the process. For **reframing-problems**, co-production interventions allow for new issues to surface, and create a more open-ended outcome. While this may allow for more creative solutions, this approach may have difficulty engaging solution-oriented actors, able to access resources for implementation. In some cases, powerful actors have blocked co-production initiatives following a re-framing approach, which indicates the importance of working across the power spectrum. To avoid this pitfall, reframing problems has proven to be more successful when using complementary bottom-up and top-down processes.

Domains of urban resilience action



After having looked at the different axes for co-production for urban resilience in Section 3, this section will explore how these might be elicited across several domains of urban resilience action.

Over the last two decades, practitioners and policymakers have proposed numerous schemas to explore the breadth of possible solutions for reducing risk and enhancing resilience to shocks and stresses in urban areas. A landscape analysis from the United Nations Development Programme (UNDP) that reviewed a decade of urban resilience, found resilience initiatives focused on the provision of planning support, project preparation support, improving the data ecosystem for planning and policy in cities; networking and coalition building and community level actions to enhance resilience (Cao et al., 2021). One study drew on more than 1,500 examples of resilience-building activities to argue that solutions can be slotted into activities aimed at enhancing individual and material wellbeing, relational wellbeing, awareness, urban governance and infrastructure (Paterson and Charles, 2019). This aligns closely with the Asian Development Bank's (ADB, 2016) 'entry points for urban resilience' framework that combines existing knowledge to propose six 'solution domains': data, planning, infrastructure, capacity, community development and finance for enhancing urban resilience. It also resonates with ARUP's City Resilience Framework (Rockefeller Foundation and Arup, 2015), developed through a thorough review of approaches. It suggests that leadership and strategy, health and wellbeing, economy and society, and infrastructure, are the key domains on which the resilience of cities depends. Similarly, UNHABITAT's City Resilience Action Planning Tool proposes pillars for resilience that include governance, planning and urban design, resilient infrastructure and basic services, economy and society and disaster risk management (UN-HABITAT, 2018).

By drawing on these frameworks, the sections that follow will argue that solutions for building urban resilience fall into five categories: a) community assets and services; b) generating knowledge and information, c) building resilient infrastructure; d) enhancing governance, planning and capacity building; e) and mobilising finance through existing and innovative sources. Under each of these domains, actions can align with one or more of the axes described in section 3. The sections that follow provide empirical examples that demonstrate characteristics across these five categories.

4.1 Community: assets and services

Urban resilience interventions often respond to the core aim of securing community assets — whether material or non-material — to reduce vulnerability and exposure. This includes community food production, housing, and basic services, including health provision, income and social capital (Archer et al., 2020).

For example, in Danang, Vietnam, a project focused on the resilience of low-income housing (Tran et al., 2014). Here, the homes of low-income residents in the city lacked structural features to withstand hurricanes. Responding to this, the local Women's Union set up a revolving fund to finance structural changes to homes, such as reinforced roofs, and made it accessible to poor families. This initiative resulted in the construction of 244 houses, none of which were destroyed in Typhoon Nari, which battered the area the year after the project was complete.

The process used by the Women's Union aimed to 'empower' (section 3 — axis 1) vulnerable groups through highly contextualised relational methodologies, such as community-based resilience workshops. Starting by exploring locally-relevant technical solutions to mitigate the impact of hurricanes, these methodologies also investigated root causes of vulnerability, such as unequal gender relations, and asymmetric barriers to risk information and credit. Apart from providing safe and structurally-sound homes, this approach enabled vulnerable groups to address the reasons for this vulnerability by linking their networks to the Women's Union. This approach shows how the project was open to local insight into the problem (section 3 — axis 3), and an understanding of the issue that highlights political networks with the ability to reshape cultural and financial practices (section 2).

A range of initiatives have focused on improving access of vulnerable communities to basic services as an important route for enhancing resilience. For instance, Indore city in central India faces crippling water shortages, particularly affecting those living in informal settlements. A donor-funded urban resilience programme engaged vulnerable communities for the co-development of local water harvesting infrastructure as a sustainable solution (Prayoga, 2017). This initiative was predicated on 'brokering complex agreements' (section 3 — axis 2) between vulnerable communities and local political elites that controlled the supply of water in times of drought, as well as the use of public land for the installation of harvesting infrastructure. Also,

as discussed in section 2, brokering these agreements is an arduous task which demands an intimate understanding of institutions, practices and networks controlling the flow of commodities, such as water, and the access and control of land.

A contrasting initiative from Zaragoza city, Spain, aimed to solve the same problem, that is, water scarcity, but its orientation was towards 'behaviour change' (section 3 — axis 2). A city of 700,000 inhabitants, Zaragoza is located in a semi-arid region that receives an annual rainfall of only 314 millimetres (Climate-ADAPT, 2016). Climate change is set to worsen water security for the city, which is why the city government launched a multi-stakeholder engagement programme to encourage the more judicious use of water. This included a campaign to reduce water consumption, a demonstration of water saving technologies, developing guides and toolkits to enhance water efficiency, and securing public pledges for improved water use.

Yet another co-production initiative enhanced the access of vulnerable communities to improved water and drainage services but was oriented towards 'empowerment' (axis 1). Low-income households on the periphery of Gorakhpur city, India, face extended periods of water logging and highly unreliable water supply. However, instead of providing infrastructure to improve these services, a donor-funded initiative organised and mobilised affected communities by setting up residents' committees. These were organised to hold the city government and their locally-elected representative accountable for a sustainable and holistic solution to this problem (Bahadur and Tanner, 2021). Through repeated rounds of dialogue between these committees and government representatives, rallies and formal petitioning, the authorities provided funds to structurally improve drainage, install new water supply infrastructure and formally recognise residents' committees as a local, representative institution. The understanding of the city that informed this intervention is that by tactically convening a 'network' of residents, one can foster the production of 'credible' knowledge about their risk experience. This knowledge can then be used to question the 'legitimacy' of public institutions, putting pressure on them to redistribute public resources and services (section 2).

A few cross-cutting insights can be taken from this review. Across the examples studied, the importance of deploying relational and co-productive approaches is significant for ensuring the sustainability, integrity and equity of assets-based approaches to building urban resilience. For instance, in Vietnam, the Women's Union undertook bottom-up processes for the design of storm resilient housing that they then financed through community-based mechanisms. This is in contrast to transplanting designs from other regions and deploying formal financing methodologies that would be

inaccessible to local communities. Additionally, these examples also underline the importance of recognising structural barriers to resilience, and warn against the adoption of purely 'technocratic approaches'. This includes issues of tackling land tenure (ie benefit from investments in resilient housing are more durable if tenure belongs to the vulnerable communities) and keeping issues of intersectional vulnerabilities front and centre (ie strengthening assets without employing this lens can exacerbate existing power differences in communities).

4.2 Knowledge, data and information

Several interventions that aim to help low-income communities withstand shocks and stresses employ activities that seek to enhance knowledge and awareness as a starting point. This includes a whole gamut of initiatives spanning innovations in acquiring and analysing data on risk and providing information on potential hazards.

Community-based early warning systems fit into this category. For example, the Developing Risk Awareness through Joint Action initiative (DARAJA) works across low-income communities in Nairobi and Dar es Salaam. The initiative has resulted in the institutionalisation of a new 'decision friendly' urban early warning system (section 3 — axis 2). This has enabled communities living in the informal settlements of Nairobi and Dar es Salaam to take better preventative action ahead of high impact weather events. Surveys show that this has resulted in vulnerable groups changing their behaviour (section 3 — axis 1), that in turn has avoided loss and improved livelihoods for the communities (Resurgence, 2023).

The initiative ensures that organisations responsible for the analysis and communication of climate and meteorological information (ie met departments), effectively cater to the needs of urban communities vulnerable to hydro-meteorological shocks and stresses. DARAJA has helped stakeholders to agree on what information is needed to enhance the resilience of urban communities, when this information should be provided, and how this should be communicated (Resurgence, 2023). The initiative is now being scaled up and replicated elsewhere. For this intervention to be effective, a close analysis of the city context was essential. DARAJA mapped institutions producing and using risk knowledge and early warning information. This mapping was then used to identify where information was not reaching the right people, which helped decide how to use community groups to develop new practices in relation to early risk information (section 2).

Some approaches employed around the world also use relational approaches to produce data, models and maps to re-frame how the risk of vulnerable communities is understood (section 3 — axis 3). These new ways of understanding risk are then used to enhance urban resilience. This could be analogue or digital, and might include participatory mapping exercises (that help produce risk maps based on observational information), vulnerability assessments (that determine socio-economic factors that make communities vulnerable) and surveys (that systematically gather objective or subjective information using established protocols to ensure that different stakeholders can better understand a problem). For example, Slum Dweller's International (SDI) has pioneered 'self-enumeration' approaches through which those living in informal settlements survey their surroundings using standardised methodologies. This results in 'material' benefits where surveys have shed an entirely new light on local problems, thereby preventing slum demolition and leading to the provision of basic services to these neighbourhoods (and thereby supporting the enhancement of community assets and services) (Beukes, 2015). Essentially, through the use of methodological approaches that are standardised across geographies and comply with the norms employed by decision makers, self-enumeration facilitates slum dwellers to claim 'legitimacy' and gain credibility as a voice that needs to be considered in policymaking (section 2). There are also 'non-material' benefits, where enhanced awareness leads to more cohesive communities, catalyses processes of conscientization, and improves self-recognition among slum dwellers of themselves as 'citizens'. This in turn contributes to greater empowerment and self-respect (d'Cruz and Mitlin, 1970; Byrne, 2018; Patel et al., 2001).

These examples deliver a few important lessons. First, it is important to conceptualise urban contexts as 'knowledge ecosystems' within which knowledge and information on risk flows back and forth between stakeholders. In contrast to traditional initiatives that approach knowledge production as one-way 'information dissemination', DARAJA's success lies in its role as a mediator between actors to enhance the effectiveness of early warnings. Second, we should not only focus on 'what' knowledge is transmitted but also 'how' it is communicated. For instance, in the case of SDI's self-enumeration approaches, granular socio-economic data on risk communicated through easily understandable and standardised formats, allows diverse stakeholder groups to engage effectively.

4.3 Governance: planning and capacity building

A third cluster of approaches focus on "governance, management and other aspects of decision-making, involving actions that handle, direct, govern, or control aspects of human hazard interaction" as a starting point for enhancing urban resilience (Paterson and Charles 2019). For this, interventions aim to develop new or transform existing institutional norms through co-production methodologies.

A good example is the Transformative Urban Coalitions (TUC) initiative. This project seeks to change decision-making structures and values by working with local stakeholders to "... shift mindsets of urban citizens and decision-makers, and by building new urban coalitions" to operationalise strategies for low carbon, inclusive and resilient urban development (Walnycki, 2021). The core model of this initiative implemented across five cities in Central and South America, is the 'Urban-lab' that acts as a site for the elicitation of imaginaries of climate resilient futures. It brings low-income residents, researchers, city managers, activists and other policy actors together to reframe problems and explore innovative solutions (section 3 — axis 3). This approach for climate governance has been used to deliver a range of solutions across 5 cities in Central and South America including shifts in land-use planning to enhance urban resilience by mandating what is built, how it is built and where it is built (Bahadur and Tanner, 2021). For example, in Buenos Aires, labs determined that the expansion and development of nature-based solutions (NBS) to changes in land use planning in vulnerable neighbourhoods was the most impactful solution to pressing challenges, such as extreme heat.

An intimate understanding of the influence networks involved in the city's functioning and, significantly, their economic and political interests seems essential to facilitate dialogues able to generate inclusive ideas within sites of co-production such as 'labs' (section 2). In TUC, this was achieved to an extent through 'city profiling' exercises (Guerra et al., 2022). Besides tactically handling political and economic interests of these networks, an intervention ought to understand their vision and deploy a methodology that can reveal their conflicting perspective (section 2). This methodology should also be able to facilitate the emergence of new ideas with the capacity to inspire coalitions of stakeholders that can transgress 'business as usual development' (with its attendant risks and exclusions). In TUC, this was achieved through the use of highly participatory approaches, including 'serious games', to generate consensus among stakeholders.

Within this category, some interventions have sought to develop leadership for urban resilience, including the ability of key individuals to promote the integration of risk in government policies and protocols (Shakya et al., 2018). For instance, the activities part of the Asian Cities Climate Change Resilience Network (ACCCRN) linked stakeholders across Asian cities into a 'network' that acted as a trans-urban community of practice. This community could question the status quo on urban governance and open the possibility for new resilient futures. A subsequent initiative, the 100 Resilient Cities programme, appointed City Resilience Officers, public officials responsible for overseeing and implementing resilience strategies. City Resilience Officers aimed to promote cross-departmental agreement for systems thinking and urban resilience, overcoming the challenge of institutional compartmentalisation.

These approaches sought to re-structure systems and transform institutions, policies and planning processes (section 3 — axis 2). Both were predicated on a strategic 'contextual' analysis of institutions and networks as, for instance, decisions on where City Resilience Officers were embedded had a bearing on the resources and knowledge they could access, as well as the 'legitimacy' they could claim (section 2).

These examples deliver a few key insights on the use of governance and decision making as an entry point for enhancing urban resilience. First, it is important to consider the 'institutional' aspects of shifts in governance and decision-making processes from the very start. For instance, the TUC initiative specifically chose to focus on open, co-productive approaches for decision making that take longer than traditional top-down approaches, precisely to ensure buy-in and consensus. Second, it is vital to consider issues of interpersonal, organisational and institutional politics when using this as an entry point for resilience. This entails understanding incentives, alliances, entrenchments and levers of change. The ACCCRN initiative invested in a lead organisation, local to the cities in which the initiative was unfolding, to map these critical issues before taking action.

4.4 Infrastructure: grey and green

A fourth cluster of approaches involve "infrastructure for physical hazard defence, either based on engineering efforts (eg. sea walls) or utilising ecological properties for protection" (Paterson and Charles 2019: 333). Essentially, this group of interventions is focused on 'mainstreaming' risk into traditional infrastructure, developing new protective infrastructure or deploying NBS for tackling risk.

Governments and private sector organisations across the world are increasingly focusing on mainstreaming risk when designing traditional infrastructure and developing infrastructure to mitigate existing risk. For example, in Ho Chi Minh City, Vietnam. The city is low-lying and experiences flooding that is set to worsen with climate change (Ponzi and Iwasaki, 2014). Therefore, the city's Mass Rapid Transit system had to be 'climate-proofed' to reduce exposure and chances of disruption. This included insulating and waterproofing electrical and mechanical operating systems; and building flexible tunnel entrances and exits that can be opened and closed swiftly to prevent flooding or to eject flood waters (Bahadur and Tanner, 2021). Focusing on risk mitigation infrastructure, an archetypical example is the 'Thames barrier', built to protect London from coastal and river floods (UK Environment Agency, 2023). Its ten gates remain closed during storm surges and periods of high flow, protecting densely populated urban areas in and around London from flood exposure (ibid).

Even though technocratic 'consultation' was solicited in the processes to develop these initiatives, due to context-specific priorities and politics, both by and large delivered pre-identified solutions to well-defined problems (section 3 — axis 3) without the deployment of robust, open-ended co-production methodologies. By engaging technical staff, including engineers and urban planners, well aligned with the objective and solution to the problem, this intervention delivered a technical solution efficiently. However, a robust co-productive approach could potentially have revealed conflicting positions and alternative solutions to risk management in these contexts. And these in turn might have created more impactful and equitable solutions.

In contrast, there are examples of processes for developing infrastructure for resilience that are oriented differently. For instance, an initiative in Afghanistan mapped the existing institutional landscape and opted to work with 'community development councils'. These organisations are local networks with responsibility for development planning and implementation (section 2). The intervention drew on the legitimacy of these councils to generate bottom-up, participatory community actions for urban resilience that facilitated an open conversation about local infrastructure needs and solutions (French et al., 2019). These led to the upgrading of sewer systems, paving of roads and the provision of basic infrastructure for 170,000 households. This in turn contributed to improving wellbeing, reducing exposure and increasing adaptive capacity.

This example raises several questions that can serve as guidance for future interventions. First, while drawing on local institutions seems like an effective way to ensure that local knowledge shapes infrastructure development, one should also carefully consider how power imbalances operate within these institutions to enable

'non-naïve' engagement (section 2). The underlying strength, quality and accountability of these institutions has a clear bearing on the depth and nature of co-production. Second, while this example more clearly shows the convening power of local institutions, it is also possible to highlight that of the resilient infrastructure. Here, infrastructure activated relationships within community development councils. These activations that can open the possibility to renegotiate legitimacy and future imaginaries among their members. More generally, this invites us to consider how different infrastructure developments re-activate relations, opening them up to power negotiations (section 2).

Alongside this focus on traditional grey infrastructure, there is a gradual increase in the use of 'green infrastructure' or NBS to tackle climate and disaster risk. A good example comes from the UK, where the small town of Selsey, which lies off the country's southern coastline, was at risk of flooding from high tides and storms (Hou-Jones et al., 2021). To remedy this, an initiative undertook the construction of a seven-kilometre-long sea wall. This was built 'inland', creating 184 hectares of intertidal habitat and allowing natural patterns of tidal flooding to unfold without harming the town. A key success factor of this initiative was that it used rigorous mapping techniques and scientific analysis to structure a process of co-production and dialogue. This was sharply oriented towards brokering agreements (section 3 — axis 2) between residents' groups (that would benefit from reduced flood risk), farmers (that would need to alter grazing patterns to ensure the ecological health of the intertidal habitat), tourism companies (that agreed to promote green tourism in the habitat to make the project economically viable) and local government (that agreed to finance this development). An intimate understanding of the local political economy connecting agriculture, tourism and housing development is helpful here to avoid a solution that reproduces existing power imbalances and exacerbates local economic vulnerabilities (section 2).

In essence, there are no ex-ante, prescribed orientations for infrastructure development processes for urban resilience. In certain cases where there is an overwhelming recognition of a major, impending hazard and readily available solutions (eg, in the case of the Thames barrier and climate proofing the mass transit system in Vietnam), more directed processes might be justified. In others, where problems and solutions might be less clear and where multiple, competing interests need to align to promote resilience (eg, for the development of the intertidal habitat in the UK or local infrastructure in Afghanistan), more open and relational processes might be needed.

4.5 Finance through existing and innovative sources

Urban adaptation finance represents approximately 3-5% of total adaptation finance. This is not nearly enough to finance the breadth of resilience building initiatives needed to comprehensively reduce risk in cities of the global South (Richmond et al., 2021). Additionally, this money is disproportionately invested in activities to tackle floods, heat and extreme rainfall, while activities to ameliorate risk from major hazards such as water scarcity and storms are under resourced (ibid). This can partly explain the finding in a 2018 survey, that of the 85% of cities that reported experiencing major climate issues, 46% reported taking no actions to deal with these problems (CDP, 2019). This is the challenge that a fifth cluster of activities is attempting to solve.

One subset within the finance category are a range of activities aimed at supporting cities to raise and deploy international public finance for resilience through project preparation support (PPS) (Cao et al., 2021). ICLEI (Local Governments for Sustainability) transformative action programmes are a case in point. They act as an incubator to support local and regional governments to develop climate action projects by providing technical assistance, financial services and increased international exposure (ibid; ICLEI 2023). Another example is the World Bank's City Resilience Programme, which provides operational and technical support to mobilise public and private finance, financial and regulatory analysis, as well as transaction advisory and financing services (GFDRR, 2022). In essence, PPS initiatives are aimed at improving access to finance through the institution of policies and planning processes and as such, aim to restructure existing systems that are unable to achieve the same objectives (section 3 — axis 2).

Here, ability to access international finance mechanisms is closely related to the recognition of city institutions to comply with practices and norms within these international arenas (section 2). While the embeddedness of organisations such as ICLEI and the World Bank in these international areas ensures their understanding of these requirements, city institutions may encounter difficulties in meeting them — and not just because of a lack of knowledge and capacity. Conflicts stemming from the local political economy and cultural practices may also prevent them from meeting international financing norms. Fixing this requires an intimate understanding of the analytical dimensions of 'how a city thinks' (section 2).

There is a growing acknowledgement of how funds leveraged through international public climate finance is too slow. The preparation and approval of funding applications is not aligned with decision-making timeframes or timescales at which hazards unfold; they come with onerous conditions (environmental and social safeguards that municipalities are unable to provide); and at times, finance is available for specific activities (that do not always align with their needs) (Bahadur and Tanner, 2022).

An emerging second cluster of approaches is aimed at helping cities secure finance for resilience through 'innovative' approaches that overcome these challenges. This includes 'city resilience bonds' such as those issued in Cape Town to support the city to raise resources for tackling the crippling water crisis. 'Land value capture schemes' have also been used to finance development activities, including resilience building in Cali, Colombia. These schemes capture the increase in land value derived from regulatory decisions — such as a change in development rights or the investment in infrastructure — and invest it in green infrastructure. These innovative finance mechanisms rely typically on brokering agreements between groups (section 3 — axis 2). For instance, in Cali, agreements had to be brokered between landowners (that would need to pay tax on the increase in the value of the land), those living on the land whose value had increased, and the city government (that was attempting to institute this regime).

This cluster also includes initiatives that provide local financing to low-income urban communities, mainly for tackling vulnerability. For instance, Slum Dwellers International (SDI) help communities with micro savings and borrowing activities. Their pooled funds can then be used by residents of informal settlements to improve living conditions, secure land tenure and improve infrastructure and basic services (Smith et al., 2014). In this case, local financing for urban resilience is part of a process to 'empower' marginalised groups so they can better confront the structural issues underpinning their vulnerability (section 3 — axis 1). This is because local

pooled funds act as a symbol of collectivisation and self-organisation for vulnerable groups, allowing them to consolidate their networks and develop influence, therefore claiming a voice, legitimacy and credibility in decision-making processes at the city level. Crucially, SDI ensures that these funds are linked to one another within a city. Cities with funds are then also linked to each other within a country; and countries with cities that have these funds are federated. From this network emerges the power to leverage financial resources, knowledge and legitimacy.

As in the case of local institutions for the design of mitigation infrastructure, one should not assume that the local is safeguarded from internal conflicts or differences. An understanding of the nature of these conflicts, related to local economies or cultural understandings of the world, would go a long way to help tactically mediate conflicts within these networks, delivering effective co-production approaches (section 2).

It is important to be aware of the fact that for finance to effectively result in changes in resilience, this investment needs to be in line with the priorities of those that are most vulnerable within urban contexts through effective co-production. If this is overlooked, there will be a mismatch between resilience needs and actions, resulting in the inefficient use of resources. Additionally, the absence of effective engagement with the most vulnerable within processes of financing, can also result in non-equitable outcomes (Satterthwaite et al., 2020). Therefore, developing a finance investment framework based on justice, equity and rights co-produced with local organisations and those living in informal settlements, needs to be an integral component of urban resilience financing processes across cities of the global South.

The table below summarises the key arguments made in this section by demonstrating how diverse orientations of co-production (explored in section 3) can be elicited through the domains of action (explored in section 4).

Table 1. The axes of co-production elicited through domains of action for urban resilience

| | COMMUNITY: ASSETS AND SERVICES | KNOWLEDGE: INFORMATION AND AWARENESS | GOVERNANCE: PLANNING AND CAPACITY BUILDING | INFRASTRUCTURE: GREY AND GREEN | FINANCE: EXISTING AND INNOVATIVE SOURCES |
|---------------------------------------|---|--|--|--|---|
| Behavioural change | | Early warning systems, Kenya and Tanzania | | | |
| Empowerment | Residents' committees for resilience, India | | | Storm resilient housing, Vietnam | Local pooled funds |
| Brokering agreements | Water harvesting, India | | | NBS for reducing flood risk, UK | Land value capture for supporting resilience, Colombia |
| Systems re-structuring | | | Land use planning for urban resilience. Institutional capacity building | | Project preparation support for leveraging finance for resilience |
| Pre-identified problems and solutions | | | | Mainstreaming climate risk into mass transit systems, Vietnam Development of protective infrastructure for floods, UK | |
| (Re)framing problems | | Self-enumeration surveys in informal settlements | Urban labs, Central and South America | Participatory infrastructure development, Afghanistan | |

Looking ahead: best practices for effective co-production

5

This paper has explored how knowledge and decision making interact in a city, the different orientations that co-production interventions can follow, and the domains of urban resilience action where interventions can be rolled out. This section includes a review of literature on the topic, and delivers a set of best practices for those facilitating co-production, also known as 'boundary organisations' (Schauppenlehner-Kloyber and Penker, 2016; Ostrom, 1990, 2009; Collins and Ison, 2009; Ross et al., 2002; Gardesse, 2014; Schauppenlehner-Kloyber and Penker, 2015; Nelson et al., 2007).

- **Well demarcated boundaries:** defining who is included and excluded from co-production arrangements raises issues of representation and legitimacy. However, not establishing boundaries discourages participation, as certain groups may feel that the space is not safe for expression or too broad in its objectives to yield outcomes. A careful understanding of the power-knowledge regime in a city by those facilitating co-production processes, helps establish these boundaries. For instance, this was evident in DARAJA, where the facilitators mapped and demarcated the existing landscape of institutions and knowledge flows around early warnings prior to the project starting. They then launched a relational process to make warnings more accessible to and actionable by vulnerable groups.
- **Polycentric and multi-scalar arrangements:** establishing multiple platforms for dialogue can help facilitators to decide who is and is not included, ensuring knowledge is actionable and benefits vulnerable people. This allows each platform to identify their priorities in a safe space, before negotiating them across broader constituencies capable of putting them into action. Bringing together members of organisations operating at multiple scales, helps mobilise resources, institutional legitimacies and knowledge that would otherwise remain siloed. These connections have the potential to create transformative change. This is seen in the structure of the SDI network, where local collectives of slum dwellers are part of transnational institutional arrangements. This ensures legitimacy, knowledge and resources are mobilised effectively to co-produce local solutions to a range of problems.
- **Local definition of rules of engagement:** sustained engagement is most likely when members of co-production arrangements are able to define the rules of the collaboration and modify them during the process. There are two types of rules. Constitutional rules set out how the group is arranged and organised within wider socio-political structures. While operational rules define the procedures related to decision making, conflict resolution and consensus building. Setting these rules and adjusting them over time grants participants the capacity to include and exclude city groups, or draw and reinforce the organisational boundaries defined above. Knowing how knowledge and decision making interact will help mediate this rule setting tactically, balancing sustained engagement with inclusivity of the most vulnerable groups. It is precisely this type of constitutional and operational rule setting that is found in the labs established under the TUC initiative, as these are managed and governed entirely by those that are members of the co-production process. This in turn has helped develop solutions for climate resilience that meet local needs and are aligned with local institutional arrangements.
- **Credibility and alignment:** while leading co-production interventions, organisations must be mindful of the way they are perceived by other groups to ensure effective mediation and sustained participation (Van Kerkhoff and Lebel, 2015). Credibility and legitimacy are of paramount importance to open deliberative spaces, which facilitate learning and encourage co-responsibility for implementation plans (Clark et al., 2016; Reyer et al., 2015; Fazey et al., 2013). Open and transparent communication, shared goals and preferred approaches, and participation on equal terms, can all build trust in the leading organisation, the objective and the co-production process itself. However, to advance the interests of marginalised groups, an acknowledgement of the necessary politics of co-production also demands an awareness of the limits to trust building among broad multi-stakeholder constituencies. One should expect the resistance and silent opposition of certain groups, if not their overt confrontation. Understanding how the city thinks would help anticipate these reactions and combine trust building exercises with tactical constituent building through policy-centric and multi-scalar organisations. The Asian Cities Climate Change Resilience Network (discussed in section 4.3) reflected this idea as a local institution led co-production processes for finding urban resilience solutions in different cities. Before agreeing the best possible actions, these institutions employed a range of iterative, relational and multi-stakeholder approaches to determine the groups that would agree and disagree to the objectives of co-production.

Conclusions

6

This paper describes and reviews the mounting evidence that top-down, linear solutions for urban resilience problems are ineffectual. It argues that effective action for enhancing the ability of urban areas to ameliorate risks, must be co-produced with multiple stakeholders that play a role in building resilience. Crucially, the paper has argued that processes of co-production can only be successful when they are designed with an understanding of contextual power and political dynamics. They must also be seen through institutional arrangements, knowledge production and decision-making practices and norms, and networks that shape the flow of knowledge and resources in cities (section 2). This understanding helps organisations facilitating co-production interventions to tactically choose the orientation of their actions in relation to vulnerable and powerful groups, as well as their 'openness' to co-design objectives and solutions (section 3). Once these key decisions are made, interventions can be deployed to find solutions within several thematic domains, such as community assets and city finance, infrastructure development and governance arrangements (section 4). Ultimately, working through these tangible domains, which offer a significant convening power, interventions can seek to redress the power imbalances identified in the first place (section 2). In doing so, they can shift urban development and adaptation pathways to reduce or eliminate the risk. Organisations working in co-production will have a better chance of success when meeting a set of best practices (section 5).

In essence, this framework interprets decision making and knowledge production as two interacting domains, embedded in the same field of power relations. As such, it seeks to influence governance and decision making by reshaping power relations through the establishment of partnerships for the co-production of new understandings of a problem. This approach has been effective in identifying complex causal relations between seemingly disconnected issues. It has revealed new ways to tackle complex problems, align public and private institutions, and civil society organisations, while fostering their capacity for action. This in turn creates ways to help vulnerable populations in marginalised urban contexts, to not only function but flourish, despite climate-induced shocks and stresses.

Looking forward

This paper is an 'input' into a process commissioned by the Adaptation Research Alliance (ARA) to collaboratively identify innovative methods, processes and pathways for urban resilience. As such, the framework it presents can be deployed in urban contexts across the world to co-produce effective and contextually-relevant solutions for tackling risk.

At the time of writing, there are plans to undertake such an initiative in two cities in partnership with local organisations. Additionally, the ARA is also planning to establish a 'community of practice' that will employ the framework (in full or part) to share lessons and insights using online and in-person platforms.

To develop this further, the theoretical grounding of this framework borrowed from 'science and technology studies' can be complemented by the body of knowledge on 'cultural political ecology'. This would help to explain how intersectional identities — including gender, age, ethnicity, race and class — shape the way that risk is distributed. This will also illustrate how economic and institutional drivers, such as deregulation, land tenure and decentralisation shape urban resilience.

Pursuing these operational and conceptual development pathways will ensure that the insights in this paper deliver sustainable shifts in the understanding of urban resilience, while also resulting in effective solutions for tackling risk in urban contexts worldwide.

References

- Aarts, N and Leeuwis, C (2010) Participation and power: reflections on the role of government in land use planning and rural development. *The Journal of Agricultural Education and Extension* 16(2) 131–45.
- ADB (2016) Enhancing Urban Climate Change Resilience: Seven Entry Points for Action. ADB Working Paper No. 47. Manila: Asian Development Bank.
- Ahern, J. (2011) From fail-safe to safe-to-fail: Sustainability and resilience in the new urban world. *Landscape and Urban Planning*, 100(4) 341–3.
- Archer, D, Wijitbusaba M, Boonanan N, Pattaradeth M and Nuttavikhom P (2020) The role of collective and individual assets in building urban community resilience, *International Journal of Urban Sustainable Development* 12(2) 169–86.
- Arnstein, S R (1969) A ladder of citizen participation. *Journal of the American Institute of Planners* 35(4) 216–24.
- Avelino, F (2017) Power in sustainability transitions: analysing power and (dis)empowerment in transformative change towards sustainability. *Environmental Policy and Governance* 27(3–4) 505–20.
- Bahadur, A V and Tanner, T (2021) Resilience reset: Creating resilient cities in the global South. Routledge.
- Beukes, A (2015) Making the Invisible Visible: Generating Data on “Slums” at Local, City and Global Scales. London: International Institute for Environment and Development.
- Boonstra, B and Boelens, L (2011) Self-organization in urban development: Towards a new perspective on spatial planning. *Urban Research & Practice* 4(2) 99–122.
- Bovaird, T (2007) Beyond engagement and participation: User and community coproduction of public services. *Public Administration Review* 67(5) 846–60.
- Boykoff, M (ed.) (2009) *The Politics of Climate Change: A Survey* (1st edn). Routledge.
- Brandt, U S and Svendsen, G T (2013) Is local participation always optimal for sustainable action? The costs of consensus-building in Local Agenda 21. *Journal of Environmental Management* 129C, 266–73.
- Bremer, S and Meisch, S (2017) Co-production in climate change research: reviewing different perspectives. *Wiley interdisciplinary reviews: Climate Change* 8(Suppl. 3) e482.
- Byrne, J (2018) *Know Your City: Slum Dwellers Count*. Cape Town: South Africa
- Cao, Y, Wilkinson, E, Pettinotti, L, Colenbrander, S and Lovell, E (2021) A Decade of Urban Resilience: An Analytical Review, UNDP.
- CDP (2019) *Cities at Risk: Dealing with the pressures of Climate Change*. Available at: <https://www.cdp.net/en/research/global-reports/cities-at-risk>, accessed on 25th April 2023
- Chen, J-S, Tsou, H-T and Ching, R K H (2011) Co-production and its effects on service innovation. *Industrial Marketing Management* 40(8), 1331–46.
- Christie, P et al (2017) Why people matter in ocean governance: incorporating human dimensions into large-scale marine protected areas. *Marine Policy* 84, 273–84.
- Clark, W C, Kerkhoff, L, van Lebel, L and Gallopin, G C (2016) Crafting usable knowledge for sustainable development. *Proceedings of the National Academy of Sciences* 113(17) 4570–8.
- Climate-ADAPT (2016) Zaragoza: Combining awareness raising and financial measures to enhance water efficiency. Retrieved 23 Aug, 2023, from <https://climate-adapt.eea.europa.eu/metadata/case-studies/zaragoza-combining-awareness-raising-and-financial-measures-to-enhance-water-efficiency>
- Cockburn, J et al (2016) How to build science–action partnerships for local land-use planning and management: lessons from Durban, South Africa. *Ecology and Society* 21(1) 28.
- Cockburn, J, Cundill, G, Shackleton, S and Rouget, M (2018) Towards place based research to support social–ecological stewardship. *Sustainability* 10(5) 1434.
- Collins, K and Ison, R (2009) Jumping off Arnstein's ladder: social learning as a new policy paradigm for climate change adaptation. *Environmental Policy and Governance* 19(6) 358–73.

- d'Cruz, S and Mitlin, A (1970) Shack/Slum Dwellers International: One experience of the contribution of membership organizations to pro-poor urban development. London: IIED
- Desouza, K C and Flanery, T H (2013) Designing, planning, and managing resilient cities: A conceptual framework. *Cities*, 35, 89–99.
- Dorst, K, Kaldor, L, Klippan, L, and Watson, R (2016) Designing for the common good. BIS Publishers.
- Fazey, I, Evely, A C, Reed, M S, Stringer, L C, Kruijssen, J, White, P V L, Newsham, A, Jin, L, Cortazzi, M, Phillipson, J et al. (2013) Knowledge exchange: A review and research agenda for environmental management. *Environmental Conservation* 40(1) 19–36.
- Filippi, M E, Barcena, A, Trogrlić, R Š, Cremen, G, Menteşe, E Y, Gentile, R and McCloskey, J (2023) Interdisciplinarity in practice: Reflections from early-career researchers developing a risk-informed decision support environment for Tomorrow's cities. *International Journal of Disaster Risk Reduction*, 85, 103481.
- Folke, C, Hahn, T, Olsson, P and Norberg, J (2005) Adaptive governance of social-ecological systems. *Annual Review of Environment and Resources* 15(30) 441–73.
- Foster, S (2011) Collective action and the urban commons. *Notre Dame Law Review* 87(1) 57–133.
- French, M, Popal, A, Rahimi, H, Popuri, S and Turkstra, J (2019) Institutionalizing participatory slum upgrading: A case study of urban co-production from Afghanistan, 2002–2016. *Environment and Urbanization* 31(1) 209–30.
- Gardesse, C (2014) The fraught “menage à trois” of public actors, private players and inhabitants: Problems of participation in French urban development projects. *Urban Studies*, 312–48.
- GFDRR (2022) City Resilience. Available at <https://www.gfdr.org/en/crp>, accessed on 28 May 2023.
- Goldstein, B E (2009) Resilience to surprises through communicative planning. *Ecology and Society* 14(2) 33.
- Guerra, F, Merlinsky, G, Hardoy, J, Kozak, D, Roll, M, Tobias, M and Pereira, P (2022) TUC City Profile No. 1: Buenos Aires, Argentina. Bonn: United Nations University. Institute for Environment and Humans Security (UNU-EHS).
- Harvey, B., Cochrane, L and Epp, M V (2019) Charting knowledge coproduction pathways in climate and development. *Environmental Policy and Governance* 29, 107–17.
- Hou-Jones, X, Roe, D and Holland, E (2021) Nature-based Solutions in Action: Lessons from the Frontline. London. Bond.
- ICLEI (2023) Transformative Actions Program (TAP). Available at <https://iclei.org/tap/>, accessed on 17th May 2023.
- Järvi, H, Kähkönen, A-K and Torvinen, H (2018) When value co-creation fails: reasons that lead to value co-destruction. *Scandinavian Journal of Management* 34(1) 63–77.
- Jasanoff, S (2004) The idiom of Co-Production. In: Jasanoff, S (ed.) *States of Knowledge: The Co-Production of Science and Social Order*. Routledge: London, UK, pp. 1–13.
- Kaika, M (2005) City of Flows: Modernity, Nature, and the City (1st edn). Routledge.
- Lang, D J, Wiek, A, Bergmann, M, Stauffacher, M, Martens, P, Moll, P and Thomas, C J (2012) Transdisciplinary research in sustainability science: practice, principles, and challenges. *Sustainability Science* 7(1) 25–43.
- Lemos, M C et al (2018) To co-produce or not to co-produce. *Nature Sustainability* 1(12) 722–4.
- Lövbrand, E (2011) Co-producing European climate science and policy: a cautionary note on the making of useful knowledge. *Science and Public Policy* 38(3) 225–36.
- Maslow, A H (1943) A theory of human motivation. *Psychological Review* 50(4) 370–96.
- Miller, C A and Wyborn, C (2018) Co-production in global sustainability: histories and theories. *Environmental Science & Policy* 113(2) 88–95.
- Miller, C and Muñoz-Erickson, T A (2017) Designing Knowledge. In: *The Rightful Place of Science*, Book Series. Arizona State University: Tempe, AZ.
- Miller, C, Muñoz-Erickson, T A and Monfreda, C (2010) Knowledge Systems Analysis: A Report to the Advancing Conservation in a Social Context. In *CSPO Report 10-05*. Arizona State University: Tempe, AZ.
- Muñoz-Erickson, T A, Miller, C A and Miller, T R (2017) How cities think: Knowledge co-production for urban sustainability and resilience. *Forests* 8(6) 203.
- Muñoz-Erickson, T A (2014) Co-production of knowledge-action systems in urban sustainable governance: The KASA approach. *Environmental Science & Policy* 37(45) 182–91.
- Musch, A-K and von Streit, A (2020) (Un)intended effects of participation in sustainability science: a criteria-guided comparative case study. *Environmental Science & Policy* 104(4) 55–66.
- Nelson, D R, Adger, W N and Brown, K (2007) Adaptation to environmental change: Contributions of a resilience framework. *Annual Review of Environment and Resources* 32(1) 395–419.

- Norström, A V et al (2020) Principles for knowledge co-production in sustainability research. *Nature Sustainability* 3(3) 182–90.
- Ostrom, E (2009) Design principles of robust property-rights institutions: What have we learned? In: Ingram, G K and Hong, Y-H (eds) *Property Rights and Land Policies*. Lincoln Institute of Land Policy: Cambridge, MA, pp. 25–51.
- Ostrom, E (1990) *Governing the Commons: The Evolution of Institutions for Collective Action*. Cambridge University Press: Cambridge, NY.
- Patel, S, Burra, S and D'Cruz, C (2001) Slum/Shack Dwellers International (SDI) – foundations to treetops. *Environment and Urbanization* 13(2) 45–59.
- Paterson, B and Charles, A (2019) Community-based responses to climate hazards: Typology and global analysis. *Climatic Change*, 152(3–4) 327–43.
- Peck, J (2011) Geographies of policy: From transfer-diffusion to mobility-mutation. *Progress in Human Geography* 35(6) 773–97.
- Pelling, M and Dill, K (2010) Disaster politics: tipping points for change in the adaptation of sociopolitical regimes. *Progress in Human Geography* 34(1) 21–37.
- Pelling, M, High, C, Dearing, J and Smith, D (2008) Shadow spaces for social learning: a relational understanding of adaptive capacity to climate change within organisations. *Environment and Planning A*, 40(4) 867–84.
- Pelling, M and Manuel-Navarrete, D (2011) From resilience to transformation: the adaptive cycle in two Mexican urban centers. *Ecology and Society* 16(2).
- Ponzi, D and Iwasaki, H (2014) *Climate Proofing ADB Investment in the Transport Sector: Initial Experience*. Manila: Asian Development Bank.
- Prayoya, N (2017) Urban resilience in a land of flood and drought, a tale of three cities: Chennai, Indore & Surat. Retrieved on 28 August, 2023 <https://www.acccrn.net/blog/urban-resilience-land-flood-and-drought-tale-three-cities-chennai-indore-surat>
- Resurgence (2023) DARAJA: The Inclusive City-Community Forecasting and Early Warning Service. Retrieved on 25th August 2023 from <https://www.resurgence.io/solutions/climate-risk-visualisation-and-communication/daraja/>.
- Richmond, M, Upadhyaya, N, and Pastor, A (2021) *An Analysis of Urban Climate Adaptation Finance*. Manila: Asian Development Bank.
- Rockefeller Foundation and Arup (2015) *City Resilience Framework*. <https://www.rockefellerfoundation.org/wp-content/uploads/City-Resilience-Framework-2015.pdf>
- Ross, H, Buchy, M and Proctor, W (2002) Laying down the ladder: A typology of public participation in Australian natural resource management. *Australasian Journal of Environmental Management* 9(4) 205–17.
- Satterthwaite, D, Archer, D, Colenbrander, S, Dodman, D, Hardoy, J, Mitlin, D and Patel, S (2020) Building resilience to climate change in informal settlements. *One Earth* 2(2) 143–56.
- Schauppenlehner-Kloyber, E and Penker, M (2016) Between participation and collective action—From occasional liaisons towards long-term co-management for urban resilience. *Sustainability* 8(7) 664.
- Schauppenlehner-Kloyber, E and Penker, M (2015) Managing group processes in transdisciplinary future studies: How to facilitate social learning and capacity building for self-organised action towards sustainable urban development? *Futures* 65, 57–71.
- Shakya, C, Cooke, K, Gupta, N, Bull, Z and Greene, S (2018) *Building Institutional Capacity for Enhancing Resilience to Climate Change: An Operational Framework and Insights From Practice*. Action on Climate Today Learning Paper. New Delhi: ACT.
- Smith, B, Brown, D and Dodman, D (2014) *Reconfiguring Urban Adaptation Finance*. London: International Institute for Environment and Development.
- Temenos, C and McCann, E (2013) Geographies of policy mobilities. *Geography Compass* 7(5) 344–57.
- Tran, P, Tran, T H and Tran, A T (2014) *Sheltering from a Gathering Storm: Typhoon Resilience in Vietnam*. Boulder, CO: ISET.
- Tritter, J Q and McCallum, A (2006) The snakes and ladders of user involvement: Moving beyond Arnstein. *Health Policy* 76(2) 156–68.
- Turnhout, E, Metze, T, Wyborn, C, Klenk, N and Louder, E (2020) The politics of co-production: participation, power, and transformation. *Current Opinion in Environmental Sustainability* 42, 15–21.
- UK Environment Agency (2023) *The Thames Barrier*. Accessed on <https://www.gov.uk/guidance/the-thames-barrier> accessed on 10th July 2023
- UNHABITAT (2018) *CityRAP Tool City Resilience Action Planning Tool*. Nairobi: UN-HABITAT
- Valdivia, B (2018) Del urbanismo androcéntrico a la ciudad cuidadora. *Hábitat y Sociedad* 11, 65–84. [From androcentric urbanism to the caring city]
- van der Hel, S (2016) New science for global sustainability? The institutionalisation of knowledge co-production in Future Earth. *Environmental Science & Policy* 61, 165–75.

- Van Kerkhoff, L, Munera, C, Dudley, N, Guevara, O, Wyborn, C, Figueroa, C and Becerra, L (2019) Towards future-oriented conservation: Managing protected areas in an era of climate change. *Ambio*, 48, 699–713.
- Van Kerkhoff, L E and Lebel, L (2015) Coproductive capacities: rethinking science-governance relations in a diverse world. *Ecology and Society* 20(1).
- Verschuere, B, Brandsen, T and Pestoff, V (2012) Co-production: the state of the art in research and the future agenda. *Voluntas* 23, 1083–101.
- Walnycki, A (2021) Transforming cities, transforming lives. Accessed on 23rd March 2023 from <https://www.iied.org/transforming-cities-transforming-lives>
- Williams, J (2005) Designing neighbourhoods for social interaction: The case of cohousing. *Journal of Urban Design* 10(2) 195–227.
- Wyborn, C, Datta, A, Montana, J, Ryan, M, Leith, P, Chaffin, B, Miller, C and Van Kerkhoff, L (2019) Co-producing sustainability: reordering the governance of science, policy, and practice. *Annual Review of Environment and Resources* 44: 319–46.
- Wyborn, C (2015) Co-productive governance: A relational framework for adaptive governance. *Global Environmental Change* 30, 56–67.

Enhancing urban resilience to climate change is a complex problem. Top-down, linear design, implementation and monitoring programmes are not sufficient. Instead, interventions that work with civil society organisations, policymakers and academics in the co-production of more inclusive representations of urban risk and resilience priorities can more effectively influence decision making. However, for co-production interventions to be impactful they must be sensitive to the power relations that drive urbanisation and climate risk. This paper offers a framework to inform the design of co-production interventions through an understanding of context-specific politics and power.

IIED is a policy and action research organisation. We promote sustainable development to improve livelihoods and protect the environments on which these livelihoods are built. We specialise in linking local priorities to global challenges. IIED is based in London and works in Africa, Asia, Latin America, the Middle East and the Pacific, with some of the world's most vulnerable people. We work with them to strengthen their voice in the decision-making arenas that affect them — from village councils to international conventions.



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