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Pathways to transformative climate adaptation in southern African cities

Transform | make a marked change in the form and nature of
Adapt | adjust to new conditions
Climate | atmospheric conditions prevailing in an area over a long period

The *Transforming southern African cities in a changing climate* project aims to better understand the pathways to transformative adaptation in southern African cities as a response to climate change that promotes equality, inclusiveness and justice. The project is part of the Leading Integrated Research for Agenda 2030 in Africa programme, which seeks to increase the production of high quality, transdisciplinary, solutions-oriented research on global sustainability by early career scientists in Africa. LIRA2030 is funded by the Swedish Development Agency (Sida), run by the International Science Council (ISC) in partnership with the Network of African Science Academies (NASAC)

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1. Introduction

The population of southern Africa is increasingly concentrated in growing towns and cities (Parnell and Walawege, 2011; Parnell and Pieterse, 2014; UN-Habitat, 2018). Just like elsewhere in the world, urban residents are in search of more secure livelihoods, more reliable and nutritious sources of food, safer living conditions, better education and healthcare. Yet many experience the hardship of a severe lack of public services, gainful employment, affordable housing and secure land tenure. This creates conditions of high vulnerability to climate hazards, including storms, high winds, heavy rainfall, intense heat, prolonged dry spells and drought, that in turn manifest as flooded homes, streets, markets, school and clinics, damage to structures and possessions, a lack of mobility, the spread of diseases, a scarcity of food and water and associated high prices. Projections of future climate conditions suggest that many of these hazards will intensify in many places across the southern African region (Niang et al., 2014). Consequently, there are mounting calls to transform cities in ways that foster social and spatial inclusion, equitable economic opportunities, environmental sustainability and climate resilience. But what does this entail and how can it be done?

This working paper presents a review of academic and grey literature addressing transformative adaptation, with a focus on cities. First the current understanding(s) of what transformative adaptation is and entails is laid out. This is followed by a review of relevant literature that deals specifically with contexts of two case studies; Durban and Harare, with a focus on the domain of water provision and supply. As cities located in southern Africa, Harare and Durban share a number of historical and social features that have shaped the development of these cities, and will continue to do so (Parnell and Pieterse 2014). Both cities are faced with the challenge of managing water, which will become more difficult as the variable and changing climate intersects with rapid urbanization. The difference in the extent of the adaptation agenda in these two cities creates a variety of opportunities for learning and impact that this project seeks to leverage.

This working paper is a product of the Leading Integrated Research for Agenda 2030 in Africa (LIRA 2030) programme, under the workstream aimed at advancing the implementation of the Sustainable Development Goal 11 in Africa. LIRA 2030 is a 5-year programme seeking to increase the production of high-quality, integrated, solutions-oriented research on global sustainability by early career scientists in Africa. The programme supports collaborative research that explores new approaches to re-thinking urban futures in Africa, in partnership with local authorities, communities, industry and government. This working paper has been produced within one of the projects funded in the second round of LIRA 2030 led by the University of Cape Town, with partners at the University of KwaZulu Natal in South Africa and the Chinhoyi University of Technology in Zimbabwe.

This working paper draws on available literature on related topics. Findings from this literature review formed the foundation for engagements with stakeholders in case study cites (Durban and Harare). The LIRA2030 team acknowledges the gaps in available literature and the immense amount of knowledge that was still to be gained during the engagement phase.

1. Conceptualising transformative adaptation

The notion of transformative adaptation to climate change has emerged out of a recognition that climate risks and vulnerabilities are highly unequally distributed and that climate change can trigger cascading impacts through a system that can be devastating.

1.1. What is transformative adaptation?

In the climate change field, 'transformative adaptation' is a relatively new concept and as such the meaning is still being fully explored and developed. In broad terms, it is being used to talk about a way of addressing climate risks and impacts that challenges and changes the dominant underlying social, economic and political structures of society. According to Pelling et al. (2015, p.113), drawing on the work of Nelson et al. (2007), transformative adaptation refers to responses to climate change that give rise, either intentionally or unexpectedly, to "non-linear changes in the systems or their host environments…. [that] may appear as radical shifts, direction turns or step changes in normative and technical aspects of culture, development or risk management". Colloff et al. (2017) add that transformative adaptation is not about addressing climate change as a stand-alone issue. Rather transformative adaptation is based on a recognition that climate change combines with other drivers of global change, notably population growth and urbanization, to impact on socio-ecological systems. It is the need to deal with the synergistic effects of climate change together with other global change drivers that requires transformative approaches to adaptation (Colloff et al., 2017).

The IPCC Fifth Assessment Report (2014) presents three types of transformation linked to climate change that have emerged in the scientific literature:

1. Transformative change resulting from the scaling up of adaptation, where each adaptation measure is of limited scope and impacts but the cumulative effect has transformative potential;
2. Actions taken once the limits of incremental adaptation have been reached;
3. Actions that directly seek to address the failures of development, especially by linking adaptation, mitigation and sustainable development.

Douwes (2018) argues for the importance of understanding transformative adaptation as a complex process that unfolds over time. Transformative adaptation usually begins with a catalyst that helps to initiate a new agenda; however, it is a range of catalysts, barriers, actors and implementation activities of which the relative importance may change over time, which subsequently interact at different points to advance or undermine transformative adaptation (Douwes, 2018).

Transformative adaptation as a process that works towards shifting fundamental aspects of a system should integrate opportunities for inclusive dialogue and collaborative planning (Shi et al. 2016). Although these processes work towards a planning outcome (e.g. a strategy or plan), of equal importance are the learning opportunities introduced. Social learning processes raise general awareness, build a common, anticipatory understanding of current and future risks and opportunities, as well as provide room for critical reflection, information exchange,

and innovation (Shi et al. 2016, Tschakert and Dietrich 2010). Such collaborative, social learning processes contribute to building a more holistic, shared perspective of problems and solutions to manage greater complexity (Ziervogel et al. 2016). They also support experimentation and rapid prototyping, which is essential for emergence in the face of uncertain climate change (Swilling 2017).

1.2. How is transformative adaptation different from other forms of adaptation?

Transformative adaptation is distinguished from incremental adaptation and no adaptation:

- No adaptation, or what Pelling et al. (2015) refer to as resistance, entails maintaining the status quo, proceeding with a 'business-as-usual' approach to development with no particular concern for, or emphasis placed on, deviations from the historical climate.
- Incremental adaptation is understood as measures to address proximate climate impacts with the intention of avoiding or reducing losses and damages within the parameters of how the system currently is structured and functions, i.e. interventions to protect existing system properties against climate change (Pelling et al., 2015; Lonsdale et al., 2015). Incremental adaptation is about making improvements to and increasing efficiencies of the existing system and how it works.

By contrast, transformative adaptation signals a disruption to and departure from the status quo of the current system or systems, placing an emphasis on changing the underlying causes of climate risk and vulnerability rooted in the dominant development paradigm and associated power structures. Fundamental aspects of the system that are expected to change during such transformations include: norms and values, governing rules, law or customs, and the flow and distribution of power and resources (Westley and Antadze 2010, in Moore et al. 2014, Lonsdale et al., 2015). Moore et al. (2014) argue that unless changes occur across multiple scales, affecting multiple social-ecological elements, adaptation is not considered transformative. While supporting the distinction between incremental and transformative adaptation, Park et al. (2011) argue that the two are interconnected and interdependent, as two parts of a continuous process or Adaptation Action Cycle.

Pelling et al. (2015) draw attention to the distinct ethical and procedural questions that transformative adaptation raises for decision-makers. Because the stakes are so much higher when a whole system is being radically or substantially changed, preferences for how the resulting system might work, and power over who decides what changes or transformative adaptation measures to invest in, matter greatly. Pelling et al. (2015) argue that distinguishing between transformative and incremental adaptation pushes decision-makers to weigh up actions that address proximate causes of climate risk (e.g. dwelling quality) with those that tackle the root causes (e.g. economic marginalization) and to justify their policy and investment choices.

It may be useful to recognize that transformative adaptation is used in both a normative and an analytical way. Much of the literature suggests the need for transformative adaptation based on the shortcomings and limitations of incremental adaptation within the dominant development paradigm. Transformative adaptation is deployed in a normative sense to propose a reform

agenda of what adaptation and development decisions should entail, i.e. suggesting an alternative approach and/or revised set of policies, programmes, projects and measures that could and should disrupt and destabilize the incumbent system. In these processes, a threshold is crossed and a new or alternative system is catalyzed that is expected to be better based on a prescribed set of criteria (e.g. more equitable, just, sustainable, inclusive, etc.). Often hypothetical examples are suggested to support such arguments.

Others use transformative adaptation as an analytical lens to critically examine and evaluate existing adaptation and development decisions, i.e. investigating the extent to which, or the potential for, policies, programmes, projects and measures to disrupt and destabilize the incumbent system such that a threshold is crossed and a new or alternative system emerges (with no prescriptions of what those changes or new system might be, whether 'good' or 'bad').

Because conceptualizations of transformative adaptation rest on the system as a subject of change and thereby an object of analysis, one of the primary challenges in operationalizing the concept, especially within the context of cities, is the delineation and characterization of a system such that a change in its form and/or functioning can be discerned and described. Pelling et al (2015), building primarily on the work of Harvey (2008), put forward a framework for conceptualizing and describing a adaptation system as the elements of and interactions between: individuals (including their values and identities); technologies (both material and organizational forms); livelihoods (made up of production and labour processes); discourses (both popular and policy varieties); behaviours (observed as practices and routines); environment (both biotic and abiotic); and institutions (both formal and informal that regulate or condition behaviour). These 'action spaces' or 'activity spheres' and systems co-evolve and can be the sites of transformative actions and/or outcomes driven from within or resulting from changes in other action spaces and coupled systems (Figure 1.). For example, transformation of the system may emanate from individuals rejecting a prescribed identity or the extinction of a plant species, as well as from the introduction of a new building construction material or the rise of an alternative policy discourse. But ultimately one must be able to observe and show (i.e. provide evidence for) how a change in one action space has knock-on effects or cascading impacts across the system (Moore et al. 2014), and potentially other co-evolving systems. This is methodologically challenging.

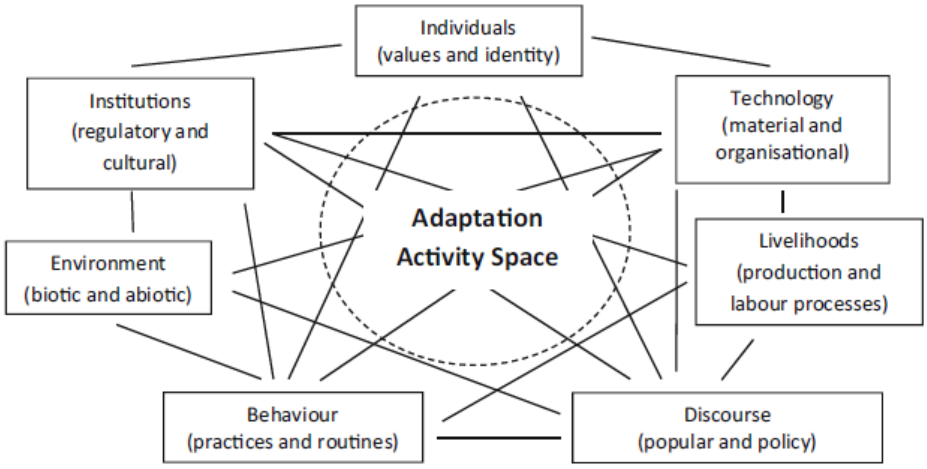

Figure 1. The adaptation activity space (Pelling et al., 2014)

Mapfumo et al. (2017), through reviewing eight cases of climate adaptation across Africa, argue that an analysis of transformational change must be based on process characteristics and not outcomes alone. They raise the important point that while definitions of transformation often refer to the size and scale of change, the relative newness of climate adaptation interventions necessitates that assessments of transformative potential consider other dimensions. Consequently Mapfumo et al. (2017) suggest the following five dimensions for assessing whether an adaptation project or intervention may be transformative or incremental:

1. The extent to which change agents are involved, how diverse / broadly representative they are and how they benefit from the process;
2. How much participation / how inclusive and broadly engaging the learning and change processes are;
3. Whether the mechanisms and pathways of change are generalizable and/or applicable beyond the project;
4. Whether the change processes may produce impacts across scales and sectors;
5. Whether the change is sustainable over time.

Pal et al. (2019), learning from a 5-year programme implementing adaptation initiatives across South Asia, propose a conceptual framework for assessing the likelihood of an adaptation initiative delivering transformation, which consists of three components (Figure 2). The first component is enabling environment factors, which are factors that contribute to achieving meaningful, lasting and fundamental change, including evidence and information, awareness, political will, the policy environment, and capacity. The second component is transformational domains, referring to areas within which transformational change takes place, such as public policy, governance, behaviour and social relations. The third component of their conceptual framework is characteristics or features of an initiative aiming to support transformation. They suggest that for an adaptation initiative to be transformative it has features that can be deemed catalytic, cross-scalar, sustainable, inclusive and systemic.

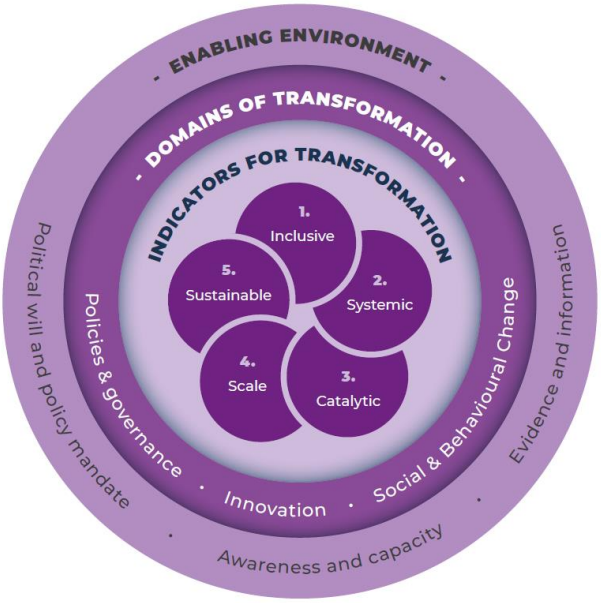

Figure 2. Conceptual framework for transformational adaptation (Pal et al., 2019)

1.3. What are examples of transformative adaptation?

Studies that apply an analytical use of transformative adaptation largely find a lack thereof, and present mechanisms and practices undermining transformative adaptation in favour of incremental adaptation or no adaptation (i.e. resistance to change and a continuation of 'business-as-usual' development). Examples of such analysis include Redclift et al. (2001) on mangrove restoration in Mexico, Schluter and Herrfahrdt (2011) on managing the Amudarya river basin in central Asia, and Marshall et al. (2012) on peanut farming in Australia. In analysing eight adaptation interventions in diverse socio-ecological settings across Africa, Mapfumo et al. (2017) similarly conclude that the cases mainly illustrate incremental adaptations and not transformative adaptation, but point towards linkages with wider processes of systems change that might lead to transformative trajectories. There seem to be few real-world cases that are deemed to be transformative adaptation; rather the argument is increasingly made that some cases of adaptation exhibit the potential for becoming transformative, if deepened, sustained, scaled up or scaled out.

The IPCC Fifth Assessment Report (2014) gives the work of eThekwini Municipality in placing ecological values at the center of urban planning as an example of transformative adaptation that seeks to address underlying failures of development (cited in Pelling et al., 2015). The details of this work form the focus of one of the case studies in this project and as such are explored further in the accompanying Durban background report (see the table in section 4 below for an overview) and in the empirical work underway.

Pelling et al. (2015), citing the IPCC (2012) Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation, give distress migration triggered by drought, and planned resettlement in anticipation of major sea level rise, as

examples of transformative adaptation. Distress migration is given as an example of transformative adaptation in response to or forced by a failure in the existing system, i.e. where a climate event triggers a breakdown in water and food supplies, livelihood activities, etc. Bylander (2015) provides a detailed analysis of migration linked to environmental stress in the case of Cambodia, as does Morrissey (2013) in the case of northern Ethiopia. Both warn against over-simplistic representations of the relationship between environmental stress (such as droughts) and migration, but both show the strong connections between them. The permanency of such migration is important for it to constitute adaptation and not an interim coping mechanism. Andersen et al. (2010) find that there is considerable evidence showing that many distress migrants return to their home areas. The empirical work on environmentally induced migration highlights that distinguishing between climate drivers and other drivers, between coping and adaptation measures, and between incremental and transformative adaptation is often difficult and contingent.

Planned resettlement is suggested as a potentially transformative adaptation measure taken in advance of, or after experiencing, debilitating climate impacts, where a new socio-ecological system is sought and occupied because the existing one becomes untenable. The case study given in the IPCC (2012) special report is that of large-scale resettlement programmes initiated in Mozambique after the devastating floods of 2000. Approximately 59,000 families were resettled out of flood-prone areas. However, it is noted that drought, water scarcity, crop failure and a lack of funds for improved livelihoods has reduced the success of the resettlement program (Stal, 2011; WMO, 2011). A recent study of urban resettlement and relocation programs in Kigali, Rwanda, similarly finds that most households experience many severely adverse impacts on their physical, financial, social, and human livelihood assets post-relocation, as well as in the period leading up to the relocation because of the uncertainties associated with the resettlement plan and implementation process (Nikuze et al., 2019). This highlights the difficulties associated with implementing such transformative adaptation measures, suggesting that both the potential benefits and the potential costs or risks need to be carefully considered, debated and negotiated in an inclusive way.

Applying an evaluation framework for assessing transformative potential to the work of the Acting on Climate today (ACT) programme, Pal et al. (2019) describe five adaptation initiatives in South Asia that display transformational features. One is establishing the use of projection-based models to increase the warning time of a flood warning system in a large river basin in India, enabling enough time for comprehensive disaster preparedness at scale. A second is reducing flood risk along a river in India by turning a problem of sedimentation into a commercial opportunity to build a self-sustaining supply chain for excessive silt in the riverbed. A third instance of transformative adaptation is an initiative to enhance the climate resilience of the agricultural sector in the Indian state of Maharashtra by strengthening the entire value-chain of climate resilient crops, for example by leveraging the resources and mandate of a large, long-term, statewide development programme to enable farmers to access credit from financial lenders for investing in such crops. The fourth case entails building the evidence base

on climate impacts at the household level in Nepal by supporting the government institution charged with undertaking surveys to carry out the survey, build its capacity to conduct similar surveys on a regular basis, strengthen the institutional commitment to studying climate change, and establishing a Climate Change Technical Committee to sustain the mandate. The fifth case of transformative adaptation in South Asia identified by Pal et al. (2019) involves supporting access to and management of international climate finance in Pakistan and Afghanistan by establishing and strengthening permanent climate finance units within the Ministry of Climate Change (MoCC) in Pakistan and the National Environmental Protection Agency (NEPA) in Afghanistan to act as nodal agencies to access and manage international climate finance, building capabilities within government to go beyond developing proposals, to managing disbursement and advising line ministries on climate change opportunities.

The complexities and nuances of the real-world examples explored in the transformative adaptation literature highlight the new, prospective and normative nature of the concept. It suggests the need for, but difficulties with, empirical testing, application, operationalization and evaluation of transformative adaptation.

1.4. Concerns with and critiques of transformative adaptation

While this working paper, and project more broadly, is primarily concerned with understanding what transformative adaptation is or might be - drawing on what is proposed in the academic literature and what those in two southern African cities imagine and experience it to be - it is important to also pay attention to critical and dissenting voices suggesting that it is a problematic idea. Blythe et al. (2018), based on a critical review and synthesis of the transformation literature, suggest five risks associated with the ways in which transformation is being framed and operationalized, as a concept and as a normative policy agenda in the sustainability field.

1. The first risk is shifting the burden of responding to global environmental change away from those influential in driving global change and onto vulnerable parties, i.e. suggesting that those who stand to be impacted worst have to change the most and thereby stand to potentially lose the most. Promoting migration as transformative adaptation can be an example of this, as it places the burden on communities and households in flood and drought prone areas.
2. The second risk is using the transformative agenda to justify the status quo or 'business-as-usual' by defining transformations so loosely and broadly that any and all change, including those that do not challenge structures within the existing system and further entrench exploitative power relations, can be labelled transformative.
3. The third risk is that pay focussing on systems at a macro scale insufficient attention is given to important social differences in the levels of access people have to decision-making and to resources, and thereby to the ways in which deliberate transformations are enacted and the impacts they have. In other words, changes implemented in the name of transformation can potentially further entrench social, economic and political inequality.

4. The fourth risk is that the systemic nature of transformation and the suggestion that the benefits of such change will be universal does not acknowledge and create spaces for resistance, opposition and contestation.
5. The fifth risk, suggested by Blythe et al. (2018), is that the sustainability transformations agenda is undermined by the lack of attention given to power and politics that results in an over-simplistic notion of how change happens and how destabilizing it is.

They heed a warning to those of us using the concept to beware of the 'dark side of transformation' and to carefully consider the plurality and politically contested nature of change (Blythe et al., 2018).

2. The need for climate adaptation that is transformative

The idea of transformative adaptation has emerged from recognizing limits to incremental adaptation (Dow et al., 2013; Barnett et al., 2015) and thereby the need for something more radical to deal with the nature, scale and pace of global climate change, and the associated risks and vulnerabilities that manifest locally. This section reviews the literature to explore why proponents of transformative adaptation suggest that it is necessary.

2.1. Why is transformative adaptation needed?

Transformative approaches to adaptation are needed because the long-term, large-scale and non-linear impacts of global change, of which climate change is one driver, cannot be adequately addressed by incremental responses (Colloff et al., 2017). The systemic nature of the drivers of change and their impacts mean that ecosystems and social systems will transform for better or for worse. The aim of undertaking deliberate transformative adaptation is to conceive of, explore, create, experiment with and implement new ways of doing things and organizing in anticipation of, and thereby to avoid, widespread and/or intensive negative impacts.

Transformative adaptation is needed because dealing only with the material aspects of climate risk, and not the social, cultural, economic and political aspects, does not address the underlying structural causes of unequal climate risk. O'Brien (2012) introduced the concept of 'deliberate transformation' as a process of planning for change in which the power asymmetries present in the current socio-economic systems are questioned and disrupted (cited in Ziervogel et al. 2016). The dominant development paradigm tends to perpetuate conditions of inequality and cycles of poverty for previously oppressed or disadvantaged groups. Conditions of poverty, of social, political and economic disempowerment, and of spatial marginalization, translate into high levels of exposure and susceptibility to climate hazards. Not only is transformative adaptation necessary in such places, it presents opportunities as adaptation norms and expectations (i.e. new mandates) are being articulated and institutionalised (Revi et al. 2014).

2.2. Why is transformative adaptation particularly pertinent to cities?

In urban areas - as built environments that are shaped by and shape people - it is particularly important to grapple with the social, economic and political complexity that gives rise to climate vulnerability and in which adaptation measures are being implemented. Dealing only with the physical dimensions of climate risk and adaptation - such as more dams to deal with drought and water scarcity, or improved insulation to deal with heat stress - does not address the underlying drivers of inequality and differential vulnerability. Where transformative adaptation aligns with objectives for social justice, underlying causes of climate risk rooted in the dominant development paradigm are interrogated, and responses to climate risks attempt to deal with the root causes of vulnerability (Moore et al. 2014, Revi et al. 2014, Ziervogel et al. 2016). Issues of people, politics and power are placed at the heart of transformative responses to climate change, thereby filling the 'gaps' that are not addressed by traditional approaches to adaptation or resilience (Bahadur and Tanner 2014).

Cities are socially dense and connected areas that provide more opportunities for transformative climate change action than rural areas (Boyd et al. 2007, in Leck and Simon 2018). The focus on power, politics and people is extremely relevant when considering responses to climate change in urban systems, which are structurally and functionally different from 'natural' ecosystems systems in which humans are not the overwhelmingly dominant force (Bahadur and Tanner, 2014).

2.3. Why is transformative adaptation particularly pertinent to cities of the global South?

Cities in the global South are seeing unprecedented population growth that far outstrips economic growth, job creation, infrastructure expansion, property development and public service provision (Parnell and Oldfield, 2014). Development paradigms that currently shape cities often result in disadvantaged, poor communities living on low-quality land, often within near proximity to hazardous features (like flood prone waterways) or polluting facilities (Shi et al., 2016). Urbanisation within this development paradigm perpetuates inequalities and, combined with the effects of climate variability and change, results in disproportionate impacts for poor and marginalised communities in cities (Steele et al., 2015). In cities of the global South, these negative climate-related impacts exacerbate the inequalities that persist from a history of colonialism and oppression (UN-Habitat, 2014). Questioning and disrupting the current development paradigm and power asymmetries in the socio-ecological system, as part of the climate adaptation agenda, is therefore particularly pertinent in cities of the global South.

Cities in South Africa, for example, are founded on spatial and socio-economic inequalities that were entrenched during apartheid (Sutherland et al., 2015). Responses to climate change, as development pathways or actions, could reinforce or even worsen inequitable or unjust aspects of a system if not critically analysed (Leck and Simon, 2018). Alternatively, climate adaptation responses offer the potential to contribute to inclusion, equality and social justice (Pelling et al. 2015). Transformative approaches to adaptation that contest dominant development paradigms are therefore needed in these contexts (Ziervogel et al., 2016).

Processes of transformative adaptation are characterised by broadened participation, planning across spatial and governance scales (thereby acknowledging linkages beyond the city), as well as promoting objectives for social justice (Shi et al., 2016). Putting social justice at the heart of transformative adaptation means acknowledging the historical roots of inequality and differential climate vulnerability, seeking to make reparations through resourcing empowerment interventions, and putting structures and mechanisms in place to move forward in a more equitable and inclusive manner.

There is, however, a need to scrutinise the idea of transformative adaptation in urban areas of the global South because the conceptual origins of transformation referred to in much of the climate adaptation literature lie within the body of resilience theory that emerged from the study of rural and natural landscapes and ecosystems in the global North, for example Canadian forests (Holling, 1973), lakes in Sweden (Olssen et al., 2004) and rivers in Australia (Walker et al., 2009). Literature from development studies dealing with societal transformation supplements the thinking that emanates from the field of ecological resilience in important ways, but the integration of these two bodies of research and literature is far from complete (Scoones et al., 2015).

3. Enablers of and constraints on enacting transformative adaptation

Having considered what transformative adaptation is and why it is needed, we now turn to reviewing the literature for suggestions of what enables and constrains the realization of transformative adaptation.

3.1. How is transformative adaptation fostered or enabled?

The literature suggests that for adaptation to be transformative everyone, across sectors and scales, has a role to play and that power over decisions and resources must shift, requiring a focus on procedural justice (Shi et al., 2016). Deliberate transformative adaptation does not occur randomly as a result of a breakdown or failure of systems (O'Brien, 2012). It is the conscious action of deeply understanding existing aspects of a system, particularly those that perpetuate vulnerability to climate change, and working towards changing these. Moore et al. (2014) describe overarching steps in the process of deliberate transformative adaptation, drawing on literature from fields of social innovation, transition management and social movements. These steps are: i) sense-making or understanding the current systems in which we exist; ii) envisioning different futures or pathways; iii) selecting a pathway for social justice that is likely to become dominant post change - which should be supported by social learning - and adopting this option; and iv) institutionalising the pathway, including building stability, as well as reflexivity.

Revi et al. (2014) suggest that evidence of transformative potential can be found in small pockets of urban areas, generally in low- and middle-income countries, where alternative forms of development are enacted by residents, often in collaboration with civil society organisations or NGOs, because the dominant development structures fail them. Therefore, to support transformative climate adaptation, Revi et al. (2014) suggest, local governments need to build relationships with stakeholders involved in these activities, and support ways in which these

alternative interventions can contribute to reducing risk in their current form, or after iteration. City governments and funders need to build capacity to liaise with civil society groups, from which much of the transformative innovation sparks and is implemented, to evaluate and take forward transformative interventions (Revi et al. 2014).

Colloff et al. (2017) argue that, due to the scale and extent of change required for transformative adaptation, including profound changes in systems of production and consumption, global and national organizations must play a key role. However, they recognize the need to redistribute power and agency to overcome the problem of powerful actors working to prevent transformative adaptation that they perceive to threaten their interests. Similarly, Mapfumo et al. (2017) highlight the importance of political will and political feasibility to undertake coordinated measures of a transformational nature in response to the threat of severe climate impacts. A related critical enabler that Colloff et al. (2017) identify is the availability of evidence of successful transformative responses, in part to reduce the uncertainties relating to risks, benefits and costs of new/alternative options, which is often what decision-makers need to make the case and gain support for a preferred course of action.

Transformative capacity, as defined by Ziervogel et al. (2016), is the "capacity of individuals and organisations to be able to both transform themselves and their society in a deliberate, conscious way". Olsson et al. (2010) describe how issues of human wellbeing should be linked to understanding socio-ecological systems to build 'transformational capacity'. Ziervogel et al. (2016) proposed three essential aspects that support transformative capacity; i) a connection with and awareness of systems and sense of self within these systems; ii) a sense of agency, nurtured alongside innovation and creativity; and iii) social cohesion. The latter two aspects should exist in a balanced way to avoid oppression (too much agency not enough social cohesion) or dependance on others to make necessary changes (social cohesion but not enough agency). If cities are viewed as "inventories of resources to be administered by politicians and bureaucratic experts" (Bollier, 2015), residents feel increasingly powerless as resources become more strained and services more degraded (Ziervogel et al., 2016). A new way of existing in cities and managing challenges such as climate change should be imagined, where agency, social cohesion and imagination is rife among residents and government working together. Furthermore, facilitating localized collaborations between municipalities and higher levels of government contributes to extending interventions beyond one geographical scale, as well as integration across policy scales (Leck and Simon, 2018).

3.2. What constrains transformative adaptation?

There is a growing body of literature exploring barriers to adaptation in general, including natural, financial, technological and social barriers, all of which are likely to be relevant to efforts at transformative adaptation (Moser and Ekstrom, 2010; Jones and Boyd, 2011; Pasquini et al., 2013; Uittenbroek et al., 2013; Biesbroek et al., 2013 and 2014; Eisenack et al., 2014; Spires et al., 2014; Barnett et al., 2015; Lehmann et al., 2015; Armah et al., 2015; Oulahen et al., 2018). Three key barriers specific to undertaking transformative adaptation identified by Colloff et al. (2017) are:

1. lack of acknowledgement of the scale - including the rate and extent - of climate change impacts on socio-economic systems and ecosystems, i.e. limited problem awareness;
2. a perceived lack of new or alternative options; and

3. powerful political and economic actors working to prevent adaptation that they perceive to threaten their interests.

Colloff et al. (2017) suggest that government responses to climate risks generally apply tried and tested options that are perceived to be largely predictable and consistent with prevailing norms, thereby engendering confidence and support, instead of new alternatives that are perceived to be complex, uncertain and risky.

Inadequate technical and financial capacities also play a major role in constraining adaptation efforts, both incremental and transformative types of adaptation. This is particularly problematic in resource-constrained environments with 'development deficits' such as southern African cities where decision makers and technicians are under much pressure from day-to-day public service delivery issues and dealing reactively with the everyday crises that exist where people are living and working informally (Leck and Simon 2018). Local governments within cities are absorbing much of the responsibility related to adaptation to climate change. Absorbing this responsibility without adequate capacity and resourcing increases the disparity between cities in the global north and those in the south (Shi et al. 2016).

Transformative adaptation that is deliberate requires deep understanding of the context in which interventions are implemented, as well as desired states towards which these interventions should contribute (Ziervogel et al. 2016). It also requires ongoing learning and feedback across multiple geographical and temporal scales. The siloed and hierarchical approach to governance, which has historically been applied throughout the globe, counters the connectedness and collaboration required for more transformative approaches (Leck and Simon 2018).

4. Transformative adaptation in the cities of Durban and Harare: need, potential and evidence

Having reviewed the international literature relating to transformative adaptation, we now turn attention to the two southern African cities in which this LIRA 2030 project is working to understand the potential for and makings of transformative adaptation: Durban in South Africa and Harare in Zimbabwe. The table below summarizes[1] the findings from reviewing published and grey literature on climate adaptation processes in the cities of Durban and Harare, focussing particularly on addressing water-related hazards and impacts.

Table 1: Comparison of climate adaptation in the cities of Durban and Harare based on reviewing published and grey literature, with a focus on water-related adaptation

[1] For the full review refer to the Durban and Harare background reports.

Variable	Durban	Harare
Climate hazards and impacts of primary concern	Intense rainfall, sea storm surges, intense heat spells and dry periods of low rainfall leading to: coastal erosion and inundation, flooding, drought and hotter temperatures impacting on water quality and availability, air quality, health impacts including loss of life, infrastructure damage including houses, schools and roads, interruption of livelihoods and jobs, increasing poverty and inequality, reduced / loss of habitats of indigenous species leading to loss of biodiversity	Intense rainfall, intense heat spells and dry periods of low rainfall leading to food security issues due to reliance on rain-fed agriculture; drought exacerbating chronic water shortages due to inadequate infrastructure; flooding damage to water infrastructure; health impacts of water scarcity, flooding and water contamination (including numerous deaths from cholera and typhoid); constraints on economic development resulting from chronic water shortages linked primarily to infrastructure and governance failure
Leadership of the climate adaptation agenda	Municipal Climate Protection Programme (MCPP), led by Environmental Protection and Climate Change Department (EPCPD) of the eThekwini Municipality	None at the city scale; national mandate in the Ministry of Environment, Water and Climate; support from UNDP and Global Water Partnership but little progress
Adaptation framing (how adaptation is thought about in cities)	Ecosystem-based adaptation (EbA) with focus on biodiversity; systemic; cross-sectoral and cross-scalar; bounce forward; linked to sustainability, green economy and job creation; inclusive and community-based	None at city scale, national focus on agriculture
Adaptation focus (how adaptation is implemented/ operationalised)	Municipal policy and planning; cross-sectoral and cross scalar coordination and collaboration; research partnerships; international networks	None at city scale, national focus on agriculture

Variable	Durban	Harare
Mainstreaming	Climate adaptation incorporated into city's Integrated Development Plan and Spatial Development Framework; dedicated climate protection branch established and resourced; Durban Climate Change Strategy (DCCS), developed as part of the MCCP, which lays out a city-wide approach to addressing CC	None
Local/city actors engaged with climate adaptation	eThekwini Municipality (notably EPCPD and EWS), political oversight of DCCS via the Municipal Climate Change Committee and administrative oversight via the Municipal Adaptation Planning Technical Task Team; UKZN; Umgeni Water; communities and industries in Palmiet River catchment	Chinhoyi University of Technology, notably via the FRACTAL project that includes reaching out to the City of Harare and Zimbabwe National Water Authority (ZINWA)
Transformative aspects	City has begun to influence and shape the global agenda (i.e. proactively working across scales); facilitating cross-sectoral interactions; strong focus on EbA in vulnerable communities linking social justice and environmental sustainability goals; emphasis on learning and knowledge networks	None
International positioning	Globally recognized as an 'early adapter'; champions Durban Adaptation Charter; represented in leadership of Intergovernmental Panel on Climate Change; member of C40 network	None in relation to climate adaptation at the city scale (Zimbabwe a signatory to the UNFCCC Paris Agreement)

Variable	Durban	Harare
Origins of adaptation agenda	ICLEI Cities for Climate Protection Programme (2000-2006); Head of the (then) Environmental Management Department partook in an advanced international environmental management programme (2004)	None at the city scale; agenda being promoted by external, international actors such as development aid partners, in partnership with local academics
Adaptation-related plans, processes and programmes	Municipal Climate Protection Programme (MCPP); Durban Climate Change Strategy (DCCS); developing municipal adaptation plans (MAPs); managing the Durban Adaptation Charter (DAC) network; 100 Resilient Cities (100RC) network activities; ecosystem-based adaptation implemented through spatial planning and land use management mechanisms in Durban Metropolitan Open Space System (D'MOSS)	None
With a water-related focus	uMngeni Ecological Infrastructure Partnership (UEIP); Sihlanzimvelo watershed ecological infrastructure and green job creation project, Palmiet Catchment Rehabilitation Project, Aller River Project	None; rather focus is on improving basic service delivery by rehabilitating old infrastructure
Key adaptation challenges	Fragmented and sprawling spatial structure of the city; entrenched socio-economic inequality; lack of policy alignment across municipal boundaries; facilitating meaningful inclusive engagement amid tensions and differences; conservative and technocentric governance cultures and practices; over-reliance on champions driving the agenda; political and public focus on short-term development gains; budget constraints for implementation	Political volatility; lack of government accountability; lack of public finances and under investment; failing infrastructure; lack of decentralization; national focus on rural and agricultural matters; lack of policy alignment and implementation

From reviewing published and grey literature on climate adaptation processes in the cities of Durban and Harare, it is clear that the two cities, while both facing considerable climate risks and impacts, are at very different stages in actively adapting to climate variability and change at the city scale. Work in Durban on understanding and addressing climate change began in the mid-2000s and has grown over the years from technical concerns with biodiversity in the environmental management sector to a cross-sectoral and multi-scalar approach that frames climate adaptation as both a socio-economic and environmental imperative and proactively links the city's agenda with international processes of driving climate knowledge and action. In contrast, Harare is a city facing political instability, chronic infrastructure deficits and a struggling economy such that governance and resource constraints seemingly leave no room for addressing climate concerns directly. A few attempts have been made by international and academics actors to introduce the agenda but with little sustained purchase either at the city or the national scale. This makes these two cities particularly interesting cases for exploring transformative adaptation, both with high exposure to climate hazards, one striving to lead the urban climate agenda internationally and the other with severe capacity constraints and a focus on basic service delivery.

5. Conclusion

From reviewing the literature it is clear that transformative adaptation refers to efforts at changing the system (be that a city, a fishing community, a river basin or an insurance industry, all with their interconnections across scales and locations) more deeply and radically than incremental adaptation that aims at reducing climate risks and impacts while maintaining the current functioning, power structures and exclusionary and exploitative practices of the incumbent system (i.e. the dominant development paradigm). Transformative adaptation is about responding to climate change in ways that see it as interconnected with problems of pollution, species loss, poverty, inequality and over-consumption that operate from the local to the global scale, and that tries to tackle the root causes of these problems, which are understood to be social, economic and political in nature and thereby not conducive to quick technological fixes. The table below summarizes the characteristics of transformative adaptation suggested in the literature.

Table of transformative adaptation characteristics

#	Characteristic	References
1	Address climate change in combination with other drivers of global change	Colloff et al. (2017)

2	Emphasize changing the underlying causes of climate risk and vulnerability rooted in the hegemonic socio-economical system and dominant development paradigm	Pelling et al. (2015), Revi et al. (2014)
3	Target systemic change, i.e. show transformative intent, giving rise to radical, 'non-linear' shifts, step changes in norms and values, governing rules or customs, and the flow and distribution of power and resources	Dowd et al. (2013); Pelling et al. (2015), Moore et al. (2014)
4	Tackle structural as well as material inequalities by challenging and disrupting power asymmetries, and contributing to social justice	Moore et al. (2014), Revi et al. (2014), Ziervogel et al. (2016), Bahadur and Tanner (2014), Shi et al. (2016)
5	Are genuinely inclusive in the sense that all affected parties are empowered to be part of the process and have an equal stake in decisions	Shi et al. (2016), Tschakert and Dietrich (2010), Ziervogel et al. (2016), Mapfumo et al. (2017)
6	Break down divisions between adaptation, mitigation and sustainable development (& DRR)	IPCC Fifth Assessment Report (2014)
7	Challenges and changes institutional governance systems when necessary	Leck (2012); Carmin et al (2012); Aylett (2013); Taylor et al (2014); Pelling et al (2015); Rosenzweig et al (2015)
8	Acknowledges the need to work across spatial, time and governance scales	Revi et al (2014a); Rosenzweig et al (2015); Leck and Simon (2018)

The above characteristics of transformative adaptation raise significant ethical and procedural challenges for decision-makers; and poses researchers with the challenges of bounding a system (in our case an urban water system) that is nested within and coupled to other systems, identifying non-linear, cross-scalar, paradigmatic changes, and evaluating shifts in equity and justice and the quality of inclusion. These are challenges we will grapple with through the case studies.

It is clear from the review that instances of transformative adaptation in action remain rare. But some potential cases are emerging, as briefly described in section 1.3 above. From existing research on such cases, enablers of transformative approaches to climate adaptation are suggested to include:

- Informality, where innovation is driven by residents and civic organisations outside of the formal state-regulated, market-driven system that has failed to adequately reduce climate risks (e.g. building informal dwellings on stilts);
- Focussing on integrating the perspectives and knowledge of residents living in intervention sites with that of technical experts, scientists, administrators and politicians;
- Working to deeply understand and change those aspects of the existing system that generate and perpetuate climate vulnerability, recognizing and seeking to break or transgress entrenched path dependencies;
- Building individual and institutional capacity to envision, explore and reflect on different adaptation pathways across the traditional silos of government, funders and financiers, civil society groups, businesses and academia, and across scales of local, national and global;
- Redistributing power and agency to overcome the problem of powerful actors working to prevent transformative adaptation that they perceive to threaten their interests;
- Building political will to undertake coordinated measures of a transformational nature in response to the threat of severe climate impacts;
- Building and making accessible an evidence base of successful transformative responses to show they are 'tried-and-tested' thereby reducing the uncertainties relating to risks, benefits and costs of new / alternative options.

Many of these enablers point to the importance of fostering spaces for experimentation and innovation, requiring flexibility and responsiveness, while creating the institutional architecture to connect up, scale out and mainstream the initiatives that show success in reducing climate risks and distributing remaining climate risks more equitably.

The main barriers to transformative adaptation are cited as being an inability to work across sectors and scales to understand the problem and work on solutions in a holistic manner, and opposition to alternative approaches and measures that challenge the status quo and undermine existing power bases. This points to the deep political, cultural, economic and organisational work that must go into taking transformative adaptation from theory into practice.

In the case of Durban, the Sihlanzimvelo project seems to be an interesting case to further explore the transformative adaptation potential for managing flood risk, especially since the C40 Finance Facility has recognised the transformative potential of the project (C40 Cities Climate Leadership Group, 2017). This streams and catchment management project focuses on the establishment of community-based cooperatives to create sustainable employment, especially for youth, to improve stormwater management through invasive alien plant clearing, litter removal and community education. This project is a form of CEbA by assisting Durban's

infrastructure to cope with the increase in storms and heavy rainfall caused by climate change. There are efforts currently underway, funded by C40 Finance Facility, to explore upscaling of this approach; this provides an opportunity for the *Transforming southern African cities in a changing climate* project to potentially contribute to ongoing planning processes. The spaces of engagement and the social learning aspects of this work are worth exploring further for transformative potential. Several, similar interventions have been implemented in Durban including *inter alia* the Palmiet Catchment Rehabilitation Programme and the Aller River Project; it is important to also consider the approaches implemented within these interventions when exploring cases of transformative adaptation.

The little climate change work that is being done in Zimbabwe is happening a national or sectoral level, with a focus on agriculture as a key economic and employment sector. As yet there is very little talk of climate adaptation in the city of Harare. Rather, the focus is on upgrading dilapidated infrastructure, like the upgrading of the water treatment works. One of the chief constraints on taking climate action at the city scale is the lack of government funds transferred from national government to the Harare city government, because it is led by the opposition party. The response to the 2009 drought and resulting cholera outbreak reveals these barriers to adaptation. In the case of Harare, rather than focussing on an existing initiative, the research will have to be more exploratory in nature, possibly using the 2009 drought as an entry point for deliberations with stakeholders over what might constitute and be required to undertake transformative adaptation to reduce Harare's drought risk in the future. This needs to look for opportunities for innovation across the formal and informal parts of the city.

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