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DATES:

Received: 06 Feb. 2020

Revised: 25 Feb. 2021

Accepted: 28 Feb. 2021

Published: 29 July 2021

HOW TO CITE:

Vogel C, Mukute M, Coetzer K, Gwata M. Creating a climate of change in the City of Johannesburg: Co-learning to adapt to climate change. *S Afr J Sci.* 2021;117(9/10), Art. #7929. <https://doi.org/10.17159/sajs.2021/7929>

ARTICLE INCLUDES:

Peer review

Supplementary material

DATA AVAILABILITY:

Open data set


All data included

On request from author(s)

Not available

Not applicable

EDITOR:

Yali Woyessa 

KEYWORDS:

climate change adaptation planning, expansive learning, Cultural Historical Activity Theory (CHAT), co-learning, transdisciplinarity

FUNDING:

City of Johannesburg

Creating a climate of change in the City of Johannesburg: Co-learning to adapt to climate change

Climate change is one of the multiple stressors facing African cities; these cities are responding by developing climate change action plans including adaptation and mitigation policies. Effectively mainstreaming climate change in city plans and operations and moving from ambition to implementation is complex. Multi-actor engagement, transdisciplinary knowledge interactions, co-designing and sustained co-learning are often required in such planning and action contexts. In this paper, we trace and reflect on the process of developing an adaptation planning process for the City of Johannesburg, South Africa. Given shortcomings of the previous adaptation responses attempted in the City, specifically that of poor uptake, we trialled a more intentional and directly designed, formative and interventionist approach using Cultural Historical Activity Theory (CHAT). We reflect on what we as a research team and City officials learnt in this process. Our findings emphasise that exploring the local context remains critical in understanding and surfacing tensions with potential climate change responses. Failure to be mindful of such issues will likely result in mere compliance, and potentially, maladaptation. Contrary to experiences in other South African settings, rather than attempting to engage all actors simultaneously, our experience suggests that working with a core group initially, before expanding the circle of actors, is needed. These actors serve as mediators and pivotal actors for learning and change, and, with appropriate authority and passion, can drive, coalesce, and potentially re-enthuse waning interest from within. They leverage already existing trust relationships and strengthen participation throughout the process. Combined, these factors are critical for ensuring implementation and legacy.

Significance:

- Careful attention to a co-designed and emergent 'Theory of Change' can help both the process and design of engaged climate change research and help to reframe the climate action needed in urban contexts.
- The collaborative processes we applied increased awareness and engagement between officials around issues of climate change and, in particular, climate change adaptation.
- The lessons and opportunities gathered in the miniature expansive learning journey we trialled may be useful for others trying to embark on climate change adaptation journeys in cities in Africa and beyond.

Introduction

Climate change adaptation planning is a key process of national and local climate change policy in South Africa. The City of Johannesburg (CoJ), together with a South African public university, the Global Change Institute of the University of the Witwatersrand, embarked on a process to review previous climate change adaptation planning in the City and then co-reframe and co-design further adaptation action with the City. In this paper, we explore how an integrated urban climate change adaptation process can be developed using a theory-informed, iterative, transdisciplinary and multi-stakeholder process. We describe the approach we used to facilitate the co-development of a CoJ Climate Change Adaptation Framework (CCAF). This laid the foundations for the processes that were then expanded for the production of the Climate Action Plan (CAP) initiated in the City by C40 (<https://www.c40.org/>). We reveal the opportunities and challenges encountered and elaborate on how they were remediated and leveraged, detailing some of what has been learnt, with the aim to assist others engaged in similar climate change adaptation journeys in urban contexts.

Climate change adaptation planning and implementation action in cities has various methodological approaches, routes and pathways that can be taken.¹⁻³ These routes of action in a city are usually not linear progressions of a set of discrete engagements. Rather, they are made up of complex, messy interactions, that have several feedback and recursive loops of planning, action, 'back to the drawing board' journeys, rethinking and 're-jigging' and then embarking on another path of action. To enable this flexibility, we chose to ground the research in formative intervention, expansive learning and transdisciplinary approaches⁴⁻⁶ with a strong emphasis on expansive learning⁷.

Formative intervention usually involves collectively reframing a problematic situation and the development, application, refinement and integration of potential solutions in work and real-life issues. This generates potentially transformative learning and action.⁸ Formative interventions have a practical interest to generate relevant solutions while meeting the rigour associated with academic research.^{8,9} This is achieved by bringing practitioners, and content and process specialists together to co-develop, test, implement and refine solutions. We worked specifically with a formative intervention method called Change Laboratory, which was developed in the context of Cultural Historical Activity Theory (CHAT) to support expansive learning. We applied the principle of double stimulation to understand and reframe the challenges associated with climate change adaptation planning in the CoJ, in a manner that would account for their causes, which are often 'invisible'.

The City of Johannesburg's adaptation journey

Urban climate change adaptation in the City

Building robust climate change response is recognised as a critical component of strengthening the capacity of '... urban areas to face sudden as well as slow-moving risks'^{10(p.39)}. The CoJ is a large metropolitan entity – the largest metropolitan municipality in South Africa, with an estimated population of around 5.74 million people.¹¹ Unemployment and youth unemployment in particular are high (32.7% and over 40%, respectively)¹¹ and contribute to a range of well-being challenges in the City. Details of the challenges (both economic and social amongst others) can be found in the City's Integrated Development Plan.¹¹ Rather than resorting to a technical review that focused on climate modelling and impacts and vulnerability assessments, we tried to situate ourselves *in the local context* of the City. In doing so, we were able to collaboratively explore some of the key multiple stresses which the CoJ faces (e.g. Bohle et al.¹², Cutter et al.^{13,14}) and surface what it may take for the City and residents to better withstand future stresses that may be aggravated by climate variability and change.¹⁵ Mindful of the various challenges the City faces, we grounded our research in the realities of the city actors (following Friend et al.¹⁶) and in the spaces that could potentially allow for transformative and integrated change (as in Mokwena¹⁷), particularly when linked to adapting to climate change.

Although the City had begun its climate change adaptation efforts in 2009, when a Climate Change Adaptation Plan (hereafter, '2009 CCA Plan') was developed, several challenges prevented it being mainstreamed into the City planning processes and everyday activities. Challenges included the lack of an integrated conceptual framework and approach which was needed to deal with the interlinked economic and socio-ecological issues of climate change impacts. The City also experienced difficulties integrating adaptation and mitigation, long-term and pressing short-term City needs, and encouraging ecosystem-based and hard infrastructure solutions into daily activities and long-term plans.¹⁸ Most notable, however, were challenges associated with the aim to 'mainstream' all climate actions across all the City's departments and spatial areas. The absence of a clearly articulated, overarching climate change policy, in which the plan could be anchored, and the lack of clear financial and other incentives to support implementation are several issues that will be expanded on in this paper, which also further exacerbated the challenge of establishing an effective climate change adaptation plan in the City.

Such challenges are not, however, unique to the CoJ and have been explored, probed and investigated elsewhere in South Africa. In eThekweni (Durban) for example, the development of the Durban Climate Change Strategy and Climate Action Plan argues for the importance of a participatory and people-centred process – involving different departments, city residents, community groups, climate organisations, civil society groups and business.³ Working in the City of Cape Town and reflecting on their engagement processes, Scott et al.^{19(p.18)} cite Chu et al.²⁰ and Ziervogel and Parnell²¹ who state that:

While adaptation outcomes are important, they need to be supported by adaptation as a process that builds capacity of different groups to adapt in different ways... These processes require time and expertise ... (emphasis added).

Complex governance and power relations^{2,22}, in various siloed departments in cities, also can work against integrative, systemic approaches for climate change adaptation planning^{15,19,21,23-25}.

In the CoJ, notwithstanding these challenges, various efforts over time have been made to begin planning for a broad climate change set of efforts, including a range of 'plans' linked to energy, water and disaster risk reduction, with few gaining any traction.²⁶ The CoJ, for a variety of reasons, has also been relying heavily on outside consultants to write their plans. Despite some value in this approach, the route we tried to pursue was a more engaged consultation process starting with people resident in departments within the City. More recently, the active engagement of C40 with an embedded person inside the City, builds on the work we helped initiate. This further influences the ways in which the

City is now planning for climate change.²⁶ For example, the Environment and Infrastructure Services Department (EISD), C40, and various actors, have now crafted and designed a Climate Action Plan (hereafter CAP) which was officially launched in June 2021.

Methodological approach

Having been invited to engage to assist the City with adaptation planning, we proceeded to meet on several occasions with representatives from the EISD, the department responsible for climate change, to co-design a plan of action. The co-engagements between the City and the University research team were also enabled by a memorandum of understanding that had been signed between the City and the wider University. The combined research team of the City and University research team agreed on the research approach and ultimate goals of the adaptation planning and engagement strategy which extended over several months of the initial stage of the research. Ethical clearance was obtained from the University of the Witwatersrand's Human Research Ethics Committee to undertake this research (Certificate: H16/06/41) and a protocol obtained was updated to ensure ongoing research relevant to this work.

The research team consisted of five researchers, including an honour's student and an external facilitator who had nearly a decade of experience in working with CHAT-informed formative interventions and expansive learning in southern Africa. The team from the University was also supported by the Head of the EISD, her deputy and the lead for climate change adaptation in the City. Over the course of the research (a period of 3 years to date and still ongoing), the team was supported by interns (an embedded researcher) who also worked in the EISD. The interns were all previously trained by the University research team.

Using the CHAT formative intervention

The central focus in the engaged work that the collective team has been doing in the City is anchored in expansive learning involving the City and the research team. In trying to overcome the challenge of poor uptake and mainstreaming of climate change action in CoJ, this research trialled a more intentional, directly co-designed, formative and interventionist approach developed in CHAT. In CHAT-informed studies, the research team acts as a deliberate interventionist, creating an environment that allows practitioners to surface and critique their current activity based on its historical development and associated historically evolving contradictions. This provides methodological guidance for the creation of new practices through major redesign of the activity system.^{7,27,28}

In CHAT, the basic unit of analysis that provides the minimal meaningful context for understanding human action is the *object-oriented activity system*, which is heterogeneous and multi-voiced.^{29,30} An activity system is composed of different elements that interact and are driven by an object to produce something with societal value. The object is the issue that drives the activity system, giving it purpose.³¹ Activity systems are dynamic in themselves and interact with other activity systems.³² The elements of a contextualised second-generation activity system are illustrated in Figure 1.

Formative intervention results are emergent and not predetermined, similar to other transdisciplinary approaches.^{4-6,31} The Change Laboratory method we used was preceded by the review of the 2009 CCA Plan and interviews with CoJ personnel to identify challenges in the Plan and in its implementation. Such approaches have been used to guide formative intervention research in different parts of the world and workplaces, including in southern Africa (e.g. Lotz-Sisitka et al.³³ and Mukute³⁴).

Change laboratories are both a place and a process where practitioners, process specialists such as CHAT scholars, and content specialists such as climate scientists and adaptation experts, together with practitioners in the City (engineers, planners and other practitioners) meet to analyse historically emerging matters of concern around an activity or practice, identify contradictions and jointly reframe the concern and develop model solutions to address it.^{9,35,36} Contradictions are viewed as 'historically accumulating structural tensions within and between activity systems'^{37(p.137)} and manifest themselves in conflict of motives among participants in an activity or in interacting activities³⁶.

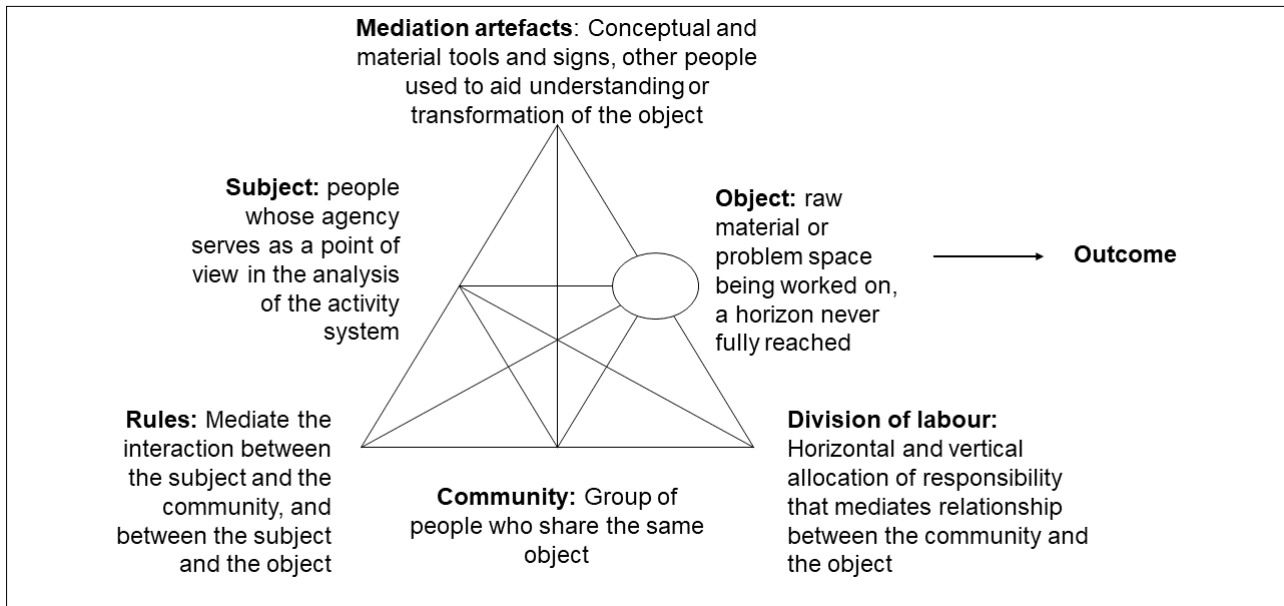


Figure 1: Elements of a contextualised second-generation activity system (adapted with permission from Engeström⁷).

The surfacing of different motives is intended to result in the development and implementation of solutions that will eventually transform work practices, relationships, objects and outcomes.³⁸ These transformations are achieved through applying the principle of double stimulation.³⁶ Double stimulation is a generative and intentional quest for change in which actors, such as organisations and people, deliberately break out of conflicting situations through joint problem-solving.³⁹ Double stimulation is an inherent and ongoing part of the process of expansive learning, which includes the following iteration:

- Questioning and analysing current activities and organisations, thereby identifying problematic matters of concern, which serve as the *first stimulus* for action;
- Identifying and using a concept that helps to reframe the problem and produce solution hypotheses is called a *second stimulus*;
- Identifying conflicts of motive and aspirations of multi-actors with a stake in the process and making choices and decisions that address the conflicts; and
- Taking volitional actions, i.e. making a deliberate decision to control one's behaviour and implementing the decision to break away from established constraints to implement the jointly agreed solutions.³⁹⁻⁴²

Change laboratories are relevant to tackling issues of climate change governance for at least three reasons:

1. They allow for the voices of different actors to be heard and considered in decision-making (at the very outset of any intervention), which is important from the perspective of democracy, agency and transformation.
2. Although individual viewpoints may remain different, the process of surfacing the variable understandings, motives and frames of reference has been found by Culwick et al.⁴³, in their work with CityLab forums, to lead to 'catalytic spaces of knowledge co-production'^{43(p.13)}. In CHAT, the surfacing of these diverse understandings acts as sources of change, innovation and development of new solutions.^{9,28}
3. Change laboratories also draw on the distributed knowledge, experience and interests of the different actors – practitioners and specialists – in problem analysis and the development of potential solutions.^{38,43}
4. They emphasise transdisciplinarity of the climate change problem-space (i.e. across disciplines, sectors and regions). This is

essential given the nature of climate change and climate change impacts, where objective scientific knowledge alone cannot account for the governance and/or social realities of 'what is happening on the ground'⁴⁴.

However, they do require considerable research and preparation before they are held; ongoing questioning and reflection between consecutive Change Laboratory sessions; time to develop mutual trust between the process researchers, practitioners and content specialists; time for collective learning, innovation and planning; time for implementing reviewing and refining solutions; time to change ways of doing things; and careful attention to issues of transformation learning and agency throughout the intervention research process.³⁴

The City of Johannesburg as an activity system

We framed the minimum activity system as the CoJ (Figure 2). In this regard, CoJ can be viewed as an activity system that produces an assortment of goods and services for its residents, including water, housing, energy, human health and protection from the effects of climate change. CoJ also interacts with other activity systems such as the corporate sector, and the Gauteng provincial and South African national governments; activity systems thus do not exist in isolation.

The *object* carries the motive force of the CoJ activity system, in this instance, climate change and its impacts. The City's departments, that should operate as a collective but often do not, are responsible for addressing the impacts of climate change on the City's stakeholders through division of labour and the use of human, conceptual and material tools, and are guided by *rules* (policies regulations, conventions and standards). These rules mediate the relationship between the City and its stakeholders, determining how the City addresses climate change. Yet different departments have different perspectives on climate change and its impact (i.e. 'multi-voicedness'). Given this, the creation of a shared object between the City departments, i.e. where there is a jointly constructed understanding, is needed to support innovation in the climate action planning and climate change adaptation problem-space (after Kerosuo et al.⁴⁵).

The City of Johannesburg's object can be viewed as a moving target for the City's adaptation response, and is unlikely to be reduced to and resolved in the short-term.⁴⁶ Instead, through the identification, development, refinement and application of *tools* of good and emergent climate change practice and policy, and supported through salient, credible and legitimate knowledge of both the urban and climate system^{47,48}, it may be transformed into the *outcome* of improved adaptive capacity to climate change over a long period⁴⁶.

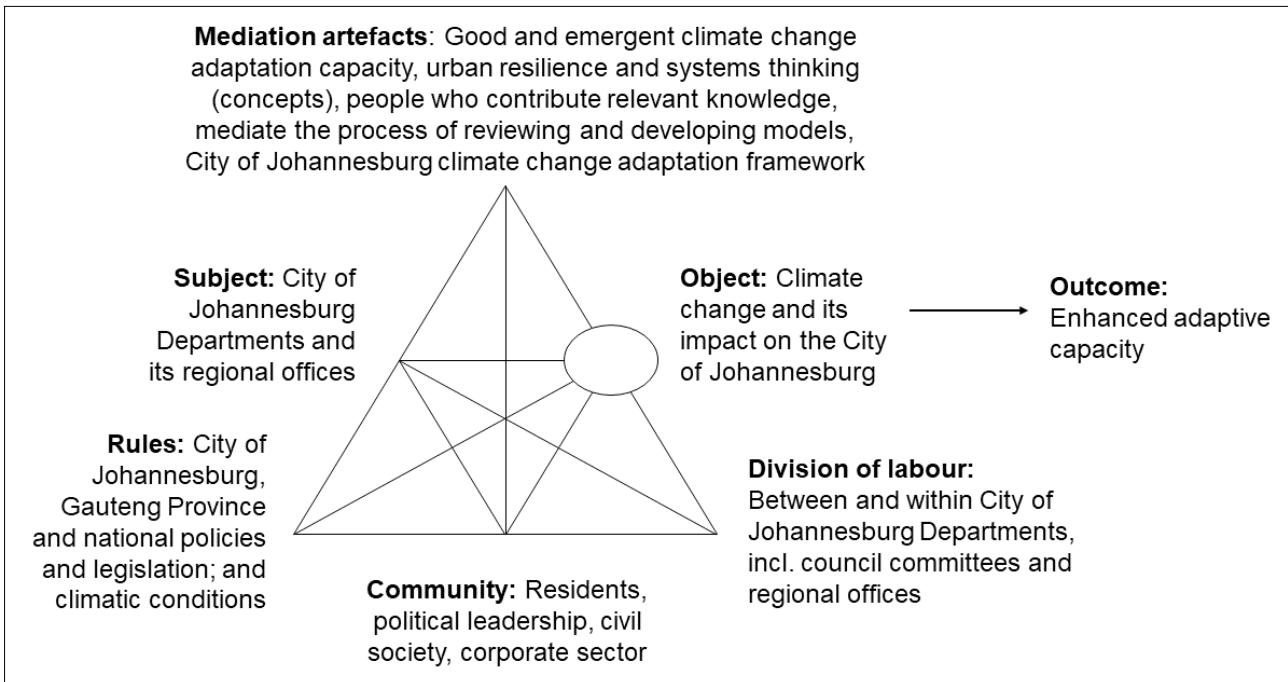


Figure 2: Activity system applied to the City of Johannesburg.

Sequence of the research steps

Our engagements with the CoJ were based on an expansive learning process and associated with four epistemic learning actions – *Questioning, Analysis, Modelling and Examining the new Model* (Figure 3, actions 5–7 still ongoing in the City) – which is typical of formative intervention research and a CHAT approach. The expansive learning cycle also, as outlined above, involves repeated cycles of applying the principle of double stimulation with first and second stimuli. The first stimulus is identified during the ‘Questioning’ and ‘Analysis’ Epistemic Actions 1 and 2, while the second stimulus is identified and used for the ‘Modelling the solution’ and ‘Examining the Model’, Epistemic Actions 3 and 4. These stimuli are subsequently used to identify, understand and refine the model solution in practice in the subsequent steps; and might result in the development and use of new solutions in an iterative process of review and analysis, solution development, implementation, review and refinement as the expansive learning process progresses.

Engeström, however, emphasises that the ‘occurrence of a full-fledged expansive cycle is not common’⁴⁹(p.385). Instead, the expansive learning cycle more typically consists of smaller cycles of innovative learning (i.e. ‘*miniature expansive learning*’), which as an *iterative collective* can support overall organisational transformation in time. In this manner, and as we detail here, the expansive learning cycle (Figure 3) and its epistemic actions (Figure 4) provide the framework for analysing the smaller-scale miniature innovative learning processes we describe⁴⁹ and support by our continued relationship with the City.

During *Epistemic Action 1*, the ‘*Questioning*’ phase, the research team conducted a document review of the original 2009 Climate Change Adaptation Plan (Table 1). The results of this review were presented to the CoJ as a first Change Laboratory ($n=27$), attended by representatives of EISD, Development Planning, Johannesburg Water, Environmental Health Department, Johannesburg Road Agency, Johannesburg Development Agency, Transport Department, and the Housing Department. This first Change Laboratory provided the forum for a discussion of the review process with the aim being to ‘mirror’ back, validate findings and further explore what the team had gathered about the City, planning processes and policies and co-design next steps in the adaptation planning process. After reflection from the Change Laboratory session, and keen to follow up on issues and ‘matters of concern’ that had been raised in the Change Lab session, attention then turned to undertaking smaller engagements.

A series of subsequent interviews with Development Planning, Spatial Planning and various members of EISD also enabled further engagement for probing identified issues further ($n=7$). These smaller meetings enabled the research team to engage more directly with City officials in a more intimate meeting setting and allowed us to better understand matters of concern that had been raised.

The research team also undertook a second document review of relevant CoJ documentation, including the Integrated Development Plans, Climate Change Strategic Framework and EISD’s Climate Change Activation and Engagement Strategy.

At a second Change Laboratory with a group of an estimated $n \geq 15$ participants (*Epistemic Action 2: ‘Presentation of findings, their validation and analysis’*), the results of the first Change Laboratory, interviews, and document review were confirmed, clustered and analysed for explanations by City departments. These first two learning actions (‘Questioning’ and ‘Analysis’) enabled co-determining why the original 2009 adaptation plan found no traction with City officials.

In *Epistemic Actions 3 and 4* (‘*Modelling*’ and ‘*Examining the Model*’), a CoJ Climate Change Adaptation Framework (CCAF) was co-developed in various smaller Change Laboratory sessions – with an average of between 2 and 6 participants. Different departments responsible for the identified issues were tasked with reframing challenges and identifying potential short-term, medium-term and long-term adaptation actions and solutions to resolve them (*Epistemic Action 3: ‘Modelling Solutions’*). These were incorporated and developed into a first-order draft of the CoJ CCAF. The development of this draft specifically sought to enhance and resource the process, conceptual and design limitations of the original 2009 CCA Plan.

The process of examining and improving the first-order draft CCAF (i.e. the ‘model solution’) took place at three levels, within and outside the CoJ (*Epistemic Action 4: Examining and Improving the Modelled Solution*). Firstly, we obtained and incorporated input from departments that had not been able to attend either of the Change Laboratories via interviews and consultations. The second level occurred through subsequent input from the interventionist researchers. Once the second-order draft CCAF was completed it was then presented to various technical and political committees in the City for wider endorsement.

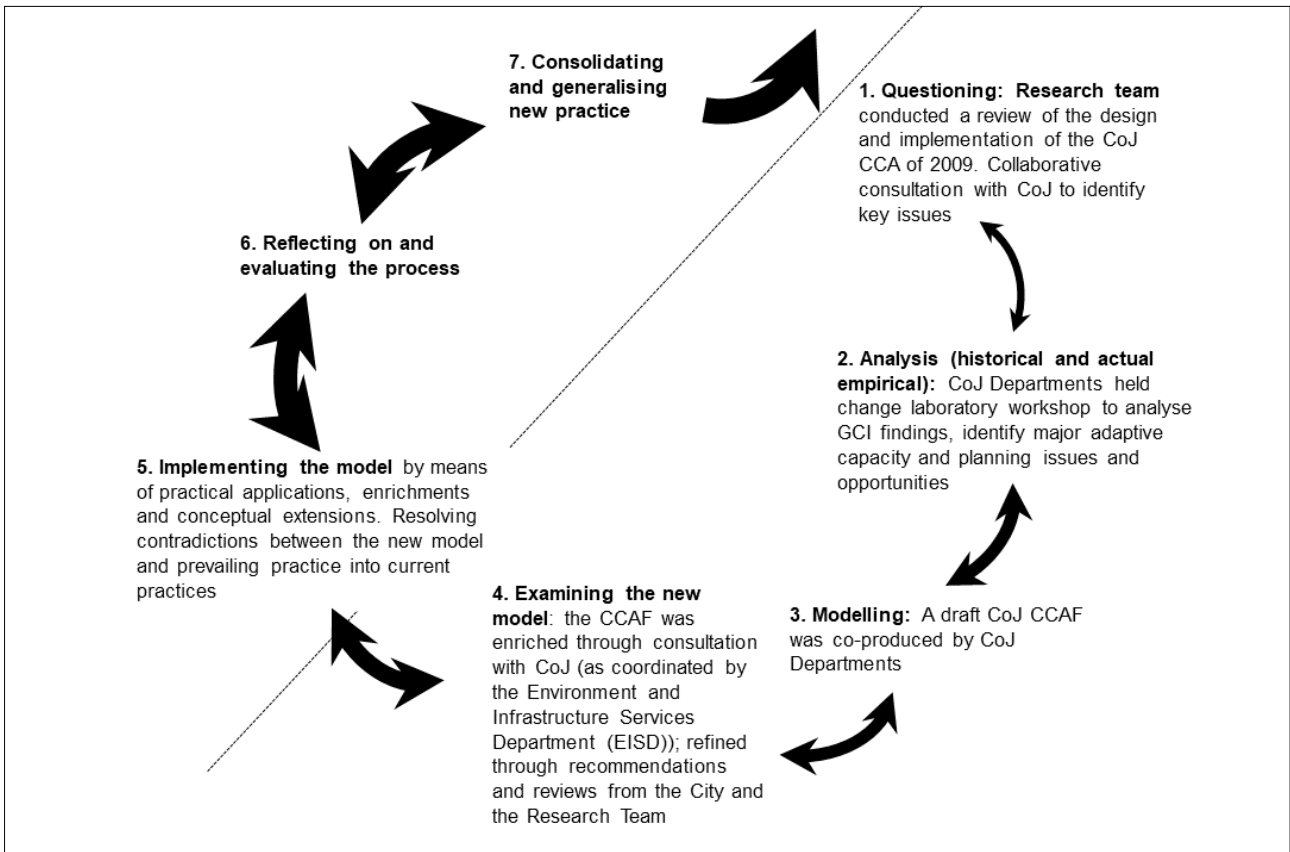


Figure 3: Expansive learning actions as applied in the City of Johannesburg's (CoJ) Climate Adaptation Framework (CCAF) development (adapted from Engeström and Sannino⁹). In the context of the results presented here, the development of the CCAF addressed epistemic learning actions 1–4. Actions 5–7 were still ongoing activities at the time of writing this paper. Arrow thickness reflects scope for and level of participation in each action. CCA = Climate Change Adaptation Plan; GCI = Global Change Institute.

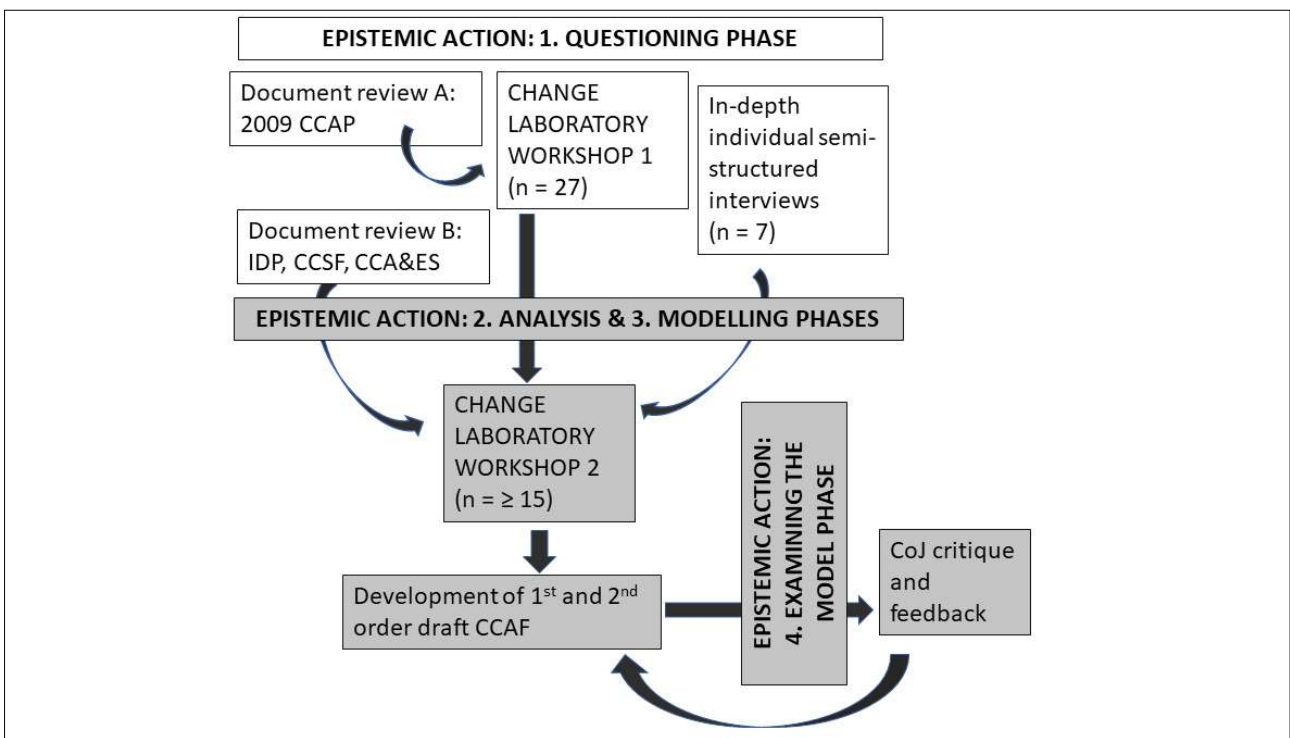


Figure 4: Research sequence of epistemic actions in the development of the City of Johannesburg's (CoJ) Climate Adaptation Framework (CCAF) including the action steps and methods used. The second Change Laboratory had more than 15 participants present ($n=15-20$), but participants arrived/left periodically due to other work-related obligations, with $n=15$ present for the full duration. CCAP = Climate Change Adaptation Plan; IDP = Integrated Development Plans; CCSF = Climate Change Strategic Framework; CCA&ES = EISD's Climate Change Activation and Engagement Strategy.

The document served before the Technical Sustainable Services Cluster meeting (a meeting of technical practitioners from EISD, City Power (Electricity Utility), Pikitup (Waste Management), Joburg Water, and Housing), and at the Mayoral and Section 79 Committees thereafter. The Mayoral Committee is chaired by the mayor and consists of all Members of the Mayoral Committee. Section 79 is a standing committee composed of various political parties and plays an oversight role, e.g. ensuring that departments use their budgets effectively. The Framework was well received at both Mayoral and Section 79 committees. These processes were key to follow and helped not only to ensure wider collective buy-in in the City, but also in expanding the learning in the City and enabling dialogues.

Results

A number of lessons and challenges have emerged through this climate change adaptation journey, several of which may have relevance and use for others embarking on similar processes in Cities. These are discussed below.

Epistemic Action 1: Questioning

The review process identified several matters of concern, surfacing tensions and contradictions between *short-term quick wins* and *long-term strategic achievements*.¹⁹ Examples of such issues included *green issues* (biodiversity concerns) and *brown issues* (basic services for sanitation); *coping strategies* and *resilience building*; *abundance of water* (flood risk) and *water scarcity* (drought) risk management; *mitigation* and *adaptation*; national and provincial climate strategies and city climate strategies; and *hard (technocratic approaches)* and *soft green responses* (e.g. wetlands). In several cases, these 'opposites' were often voiced as tensions and contradictions. In trying to ensure a green, sustainable City, for example, water management processes anchored on wetland behaviour and a wetland's ability to transform/remove pollutants and increase infiltration and stormwater storage (e.g. Mander et al.⁵⁰ and Stefanakis⁵¹), were often seen to be at odds with the more traditional, 'hard' planning and technical city engineering design approaches (e.g. storm water drainage planning):

There are few integrated plans where all the activities of the City already underway (e.g., development of Sustainable Urban Drainage Systems in the Province and the City) are linked and connected to climate change adaptation planning in the City (Interview respondent j).

In addition, a number of historical challenges and structurally embedded tensions¹⁵ emerged. These included climate change matters of *immediate concern* (including the urgent need for service delivery in the form of safe water and sanitation and energy provision, particularly in informal settlements) and the need for identifying the vulnerable (which usually are also the result of driving factors that are the result of historical imbalances but also the result of the incapacity to deliver in a City with a range of other competing demands) that all remain persistent challenges.

Epistemic Action 2: Presentation of findings, their validation and analysis

Results from the various engagements with the City revealed and confirmed a number of emerging contradictions that again draw attention to issues of *process* being an essential part of designing planning in complex city contexts:

1. *Design*: the earlier 2009 CCA Plan was not linked to the Integrated Development Plan and Growth and Development Strategy, which occupy a higher place in the hierarchy of CoJ plans; and the councillors' and practitioners' Key Performance Indicators (KPIs), which matter in everyday work. The plan also did not have a learning, monitoring and evaluation component.
2. *Implementation*: The matters of concern that were identified in the present climate change processes described above were not dissimilar to those identified in 2009. CoJ's matters of concern,

linked to climate change and climate variability, were confirmed as being water, waste, heat waves, food security, urbanisation and governance, particularly as related to planning and service delivery in the City. The expansive learning process, undertaken at least 7 years after the first Plan was drafted, furthermore validated and confirmed these issues as persistent climate change risks in the City.

These reconceptualised, interconnected (what some now refer to as intersectionality, e.g. in the case of gender and climate change⁵²), problems defined the *first stimulus* in our study. The *second stimulus* resulted in the emergence of several conceptual tools enabling further ongoing interrogation of the 'matters of concern' and the development of possible planning actions. Key amongst these were the need to focus on adaptive capacity skills and development enhancement in the City, trying to build system-wide resilient city planning and where possible to focus on engendering complexity thinking. The ways in which performance is rewarded in the City (through siloed, key performance targets) will also remain a key barrier to effective mainstreaming in the City. Several City officials noted that, while they recognise the urgency for climate change action and implementation, the lack of incentives to do so and their narrow KPIs mitigate against a more transversal and systems' approach being possible.

A number of other persistent 'matters of concern' faced by City departments as part of their day-to-day challenges also emerged from the smaller group targeted interviews (Figure 5), and those seen as specific barriers to operationalising climate change considerations surfaced (Figure 6). Observations, made by several people we interviewed, noted the following persistent matters of concern:

- the need for more coherence and co-ordination across departments and entities – 'there is no inter collaboration on climate change' (Interview respondent j);
- the need to have job 'score cards' flexible enough to allow for issues such as climate change to be addressed with ease – 'how we are being corporatised prevents us taking up climate change as a key issue' (Interview respondent x);
- 'need the regions, ward committees and the departments in Braamfontein to better align' (Interview respondent x);
- 'the huge pressures of service delivery that can obscure other efforts that may be developed' (Interview respondent x); and finally,
- the need to make climate change an 'all citizens issue' – 'there is more outside of the City that lies in the hands of others e.g., business, civic engagement than just us officials inside the City' (Interview respondent x).

Through these various interactions, a shared climate change engagement that had not yet really emerged in the City began to emerge, with many colleagues acknowledging that the adaptation process which was set in motion through this work had enabled a joint understanding of 'each other's' departmental activities. In this respect, the Change Laboratory workshop processes and interviews offered a strong case for working with the expansive learning process. They allowed for the crafting of draft 'project management plans' whereby departments began to identify key concerns and to also begin to identify departments that could work together on such issues going forward. This modelling of possible solutions (i.e. departments identifying key priority actions with targeting of long-, medium- and short-term planning including identifying which City actors wanted to engage and work together) has begun to open up cross-sectoral and transversal learning processes that are still ongoing. As will be shown below, several of these engagements have enabled the compilation of the CAP where these early engagements had not gained policy traction.



Table 1: Sequence and description of epistemic actions in the conceptualisation and development of the City of Johannesburg's (CoJ) Climate Change Adaptation Framework (CCAF)

	Epistemic action	Action step	Description of epistemic action	Result of epistemic action
QUESTIONING	Epistemic Action 0: Preparatory – organise the practitioners, content and process specialists to work together	Engaged a competent facilitator with a sense of place (process specialist)	City of Johannesburg (CoJ) engaged a research institute at a South African public University to review the 2009 Climate Change Adaptation Plan (CCAP) and facilitate the development of a CCAF over a period of 1.5 years. The research institute was selected for its technical capacity on climate change and related responses, review and planning methodological strength and for being 'part and parcel' of the City.	Partnership between CoJ (public sector – as the practitioners) and research institute (research – as the content specialist on climate and climate change adaptation)
	Epistemic Action 1: Collaborative and inclusive identification of matters of concern using multiple methods	Conducted an inclusive and robust review of the 2009 CCAP	The review assessed how the plan was developed, implemented, resourced and monitored. It was further contextualised by assessing the CCAP in relation to the CoJ and national priorities, best practice and good examples of urban adaptation planning and implementation in South Africa and beyond. It utilised document analysis, literature review and interviews with CoJ representatives.	Identification of areas needing improvement
		Held Change Laboratory 1 to present and discuss findings of the 2009 CCAP review	CoJ organised a workshop in August 2016 at which the review was presented by the research institute. The Change Laboratory was attended by 27 professionals and practitioners from various CoJ regions and departments, namely: Environment and Infrastructure Services Department (EISD), Development Planning, Johannesburg Water, Environmental Health Department, Johannesburg Road Agency, Johannesburg Development Agency, Transport Department and the Housing Department.	Approval of the review Identification of lessons learnt and key issues Establishment of an inter-departmental Task Force to steer the process
		Conducted future-oriented in-depth interviews on key issues and potential climate change adaptation solutions	Seven in-depth interviews were conducted with representatives from CoJ departments over a period of 3 months in early 2017.	Identification of new and emerging climate change related matters of concern and opportunities
		Consulted recent studies on community awareness and concerns about climate change	Studies that were reviewed included a number of documents, but more recently: (i) the Integrated Development Plans (IDP) 2017, (ii) Update on the IDP process, (iii) Climate Change Strategic Framework, 2015 and (iv) the Climate Change: Activation & Engagement Strategy prepared for EISD	Identification of climate change awareness levels among urban communities and their climate change priority issues
ANALYSIS	Epistemic Action 2: Collaborative problem analysis, elaboration and prioritisation	Presented matters of concern which were jointly analysed and prioritised	A synthesis of matters of concern was presented and discussed at a second Change Laboratory held on 2 June 2017, which was attended by members of the Task Force/Steering Committee, regional managers and staff from CoJ departments. These matters were confirmed and analysed for explanations.	Joint validation and elaboration of identified matters of concern Collective prioritisation of matters of concern Identification of linkages between the concerns
MODELLING	Epistemic Action 3: Co-development of the CoJ CCAF	Developed response strategies and actions to address matters of concern	Interconnected issues were clustered together and departments responsible for their tackling and resolutions worked together to reframe the challenges and develop strategies to address them.	Identification of the focus of the CCAF Consensus on the conceptual framework(s) to work with Outline of strategies to respond to climate change impacts in CoJ
		Compiled the draft CoJ 2017 CCAF	The 2017 draft CCAF was developed by drawing on the contributions and outputs of all the preceding epistemic actions, which were based on inputs from some of the CoJ stakeholder groups and CoJ strategic documents.	Draft CCAF with direct input from CoJ departments and indirect input from other stakeholders
EXAMINING THE MODEL	Epistemic Action 4: Examining and improving the CoJ CCAF	Presented and discussed the draft CCAF with stakeholders for their input	The priorities and main strategies of the draft CCAF were disseminated in face-to-face meetings with stakeholders in July 2017. Stakeholders gave feedback, which was incorporated in the final draft 2017 CCAF and also included into the Climate Action Plan (CAP) C40 process.	Widening of stakeholder input and increased potential for relevance and co-ownership of the CCAF

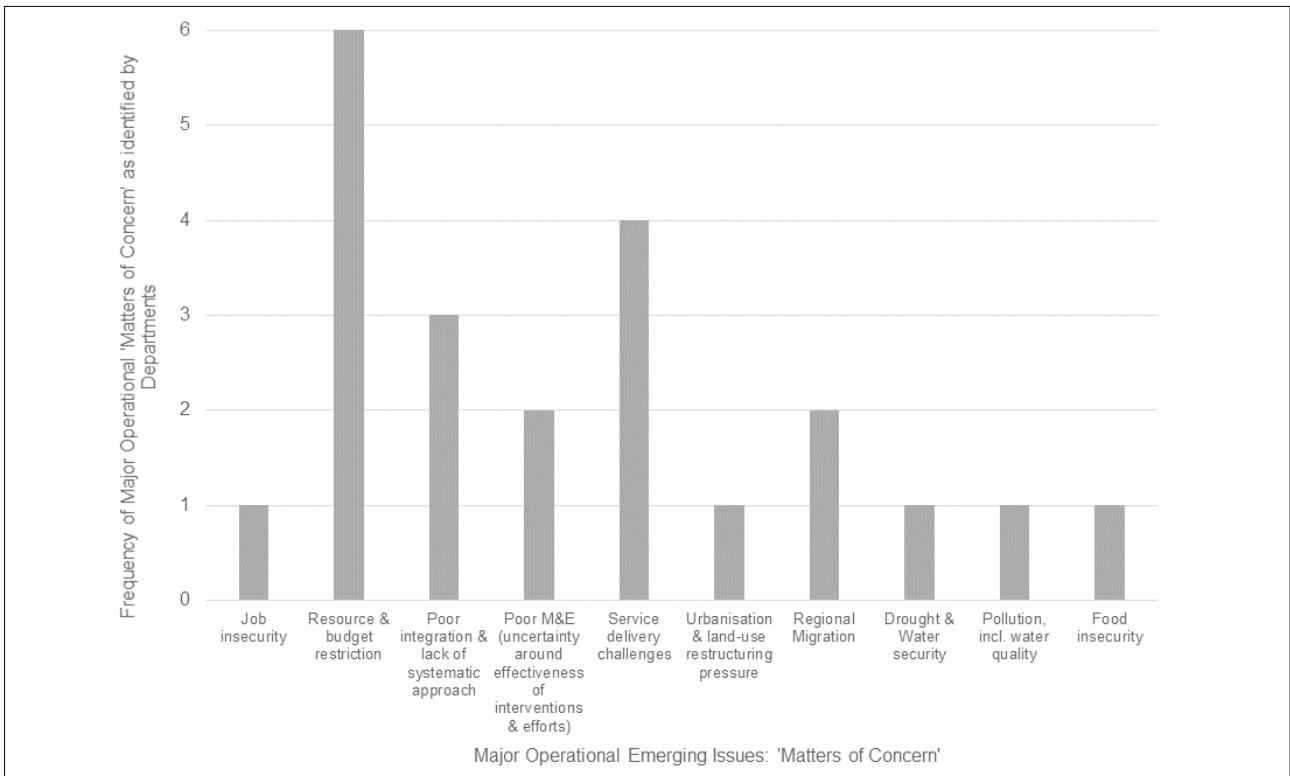


Figure 5: Emerging issues ('matters of concern') seen as major operational challenges in the City of Johannesburg's (CoJ) day-to-day activities. Operational concerns were thematically coded from individual one-on-one and small group targeted interviews conducted with representatives of different CoJ Departments (City Parks, Environment and Infrastructure Services Department, Development Planning, Disaster Management, Johannesburg Water, Environmental Health Department, Johannesburg Road Agency). Frequency is the aggregated count of themes that emerged from interview data across all Departments.

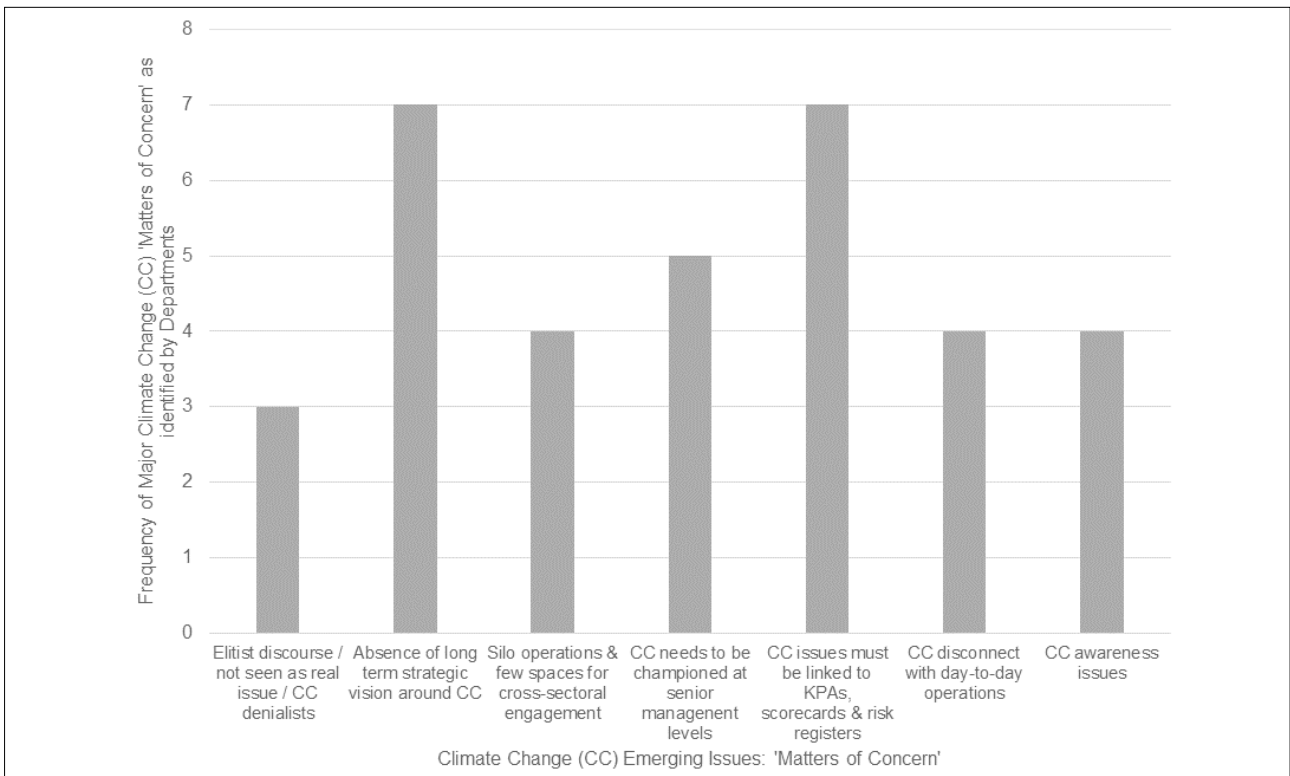


Figure 6: Emerging issues ('matters of concern') seen as potential barriers to operationalising climate change ('CC') in the City of Johannesburg's (CoJ) activities. Climate change related emerging Issues were thematically coded from individual one-on-one interviews conducted with representatives of different CoJ Departments (City Parks, Environment and Infrastructure Services Department, Development Planning, Disaster Management, Johannesburg Water, Environmental Health Department, Johannesburg Road Agency). Frequency is the aggregated count of themes that emerged from interview data across all departments.

Epistemic Actions 3 and 4: Modelling solutions and improving the 'model' solutions

The epistemic actions described above culminated in the production of the first draft CCAF. This was used as a document that could circulate through various forums in the City and receive comment and inputs, widening stakeholder input and increasing potential for relevance and co-ownership of climate change planning. In the final stages of this process of adaptation efforts in the CoJ, the City also embarked on the development of a CAP in collaboration with C40, that built on and included sections of the adaptation work described here, as well as climate change mitigation efforts.

The CAP, a mayoral agreement signed with other African City mayors all committed to a planning process and policy for climate change action, was published in March 2021. At the time of finalising this paper, the CAP had gone through the political process of approval (19 November 2020) including the approval of the draft CAP and the establishment of a Climate Action Forum going forward that will assist in reporting and the implementation of the CAP. The CAP will also be reviewed every 5 years. The Council still had to review the CAP at the time of finalising this paper (February 2021), but only a few months later, by 3 June 2021, it had been officially and publically launched.

The next steps, in which the research team has remained involved and actively engaged, include engagement with the youth and wider civic society so that climate change actions can be further designed and mainstreamed in the City and the 12 regions. The youth with whom the team has been engaging (details of which are being prepared for another publication) were able to have their inputs included directly in the CAP document – a major achievement for the youth cohorts engaged as well as the research team.

Discussion

In conducting a learning-oriented climate change adaptation process, we aimed to work in a very complex setting, both politically and institutionally, but also as honest and humble brokers of climate change action. Since the time of the commencement of this research (late 2015, early 2016) we have attempted to have a very mindful and mutual learning journey and relationship with City officials and practitioners. This relationship has included being mindful of the complex tensions that comprise the 'local context' in the City, being able to collectively identify the 'matters of concern' in the City, and then examine how these could be linked and actioned with climate change efforts. Rather than address these in an item-by-item fashion, we reflect more holistically and reflexively on what has been learnt through a process of expansive learning in the City.

The journey, as illustrated in this paper, is a long, and often frustrating one, with several moments of both an *outward* (more academic and bureaucratic learning in the City, i.e. learning about their procedures and policies and also our own academic theoretical learnings) and then an *inward, personal journey* (of self-questioning and growth), both for the research team (including the City personnel) and the actors in the wider 'outside' City we met and worked with.

Some of the 'outward' academic learnings that are emerging from this intervention research and are still ongoing are discussed below.

The main subjects of an activity system may serve as an important entry point of formative intervention. In complex activity systems such as urban Johannesburg, where there are many stakeholders including residents, councillors, the business community and civil society, it is not feasible to engage all the actors simultaneously. The City's original 2009 climate adaptation efforts lacked the participation of key stakeholder groups, including City departments, residents and the business community in issue identification. It was considered a notable limitation of the initial approach – perhaps as a result of the difficulties in engaging effectively with this diverse actor network.

However, our experience suggests that leverage can be achieved through working with a *core group of people first, i.e. key actors, before expanding the circle of actors.* By spending much time with the EISD and

then meeting various department heads and others in the City, we began a trust-building journey that earned us some credibility in the City. Such an approach runs counter to other similar engagements where efforts were focussed on 'outside engagement' simultaneously with internal (e.g. Durban/eThekwin^{53,54}). This departure from the other cases was enabled by very strong champions who were working inside the City and thus could help navigate more clearly the various forms of engagements, both internally and externally. The City now is planning subsequent, more varied actor engagements (e.g. expanding the learning to youth change agents and civic society in the regions).

Some of the subjects can also serve as mediating tools for learning and change, in the form of champions. The lead department on climate change, EISD, serves as the initial champion in the process of generating stakeholder buy-in and co-production of knowledge and potential climate change adaptation solutions. Having a lead department or individual that has the authority and the passion to drive, coalesce, and, potentially, re-enthuse waning interest when necessary *from within*, cannot be emphasised enough. When attempting to generate and consolidate new practice, the role of embedded champions becomes invaluable as they are able to leverage existing trust relationships and strengthen participation throughout the process.

Conflicts of motive among participating actors need to be carefully surfaced and contextualised. Cities operate in very siloed ways, with each department tied to specific deliverables. Engaging in dialogues and co-learning environments that are not sensitive to such contexts can easily mean disengagement with local actors at all scales and levels. The advantage of therefore spending time understanding the local context in which actors find themselves (e.g. in the expansive learning cycle; Figure 3), in understanding and surfacing tensions and contradictions cannot be underscored more heavily. Roberts^{53(p.536)}, in reflecting on developing Durban's Climate Strategy has similarly emphasised that embedding climate change considerations in the local context requires that it is 'framed within a broader social/environmental justice framework', and thereby, *internalised for local context and priorities*. This ensures the local development agenda, with its associated resource (human, time, financial) allocations, becomes more meaningfully associated with robust climate protection response; *actors need to see that their 'matters of concern' do indeed 'matter'*. Lack of doing so results in a lack of cogency in the process and can result in mere compliance (i.e. 'tick box' activities), which may result in maladaptation.

Applying the principle of double stimulation potentially enables generative learning processes. A number of tensions and contradictions surfaced at the very beginning of this process and are being probed further with other constellations of actors, e.g. civil society, mayoral executives, as the adaptation planning process continues. Issues that surfaced not only became objects of interest in themselves, but also informed the probing methodologies applied, such as double stimulation and conceptual tools on adaptation. However, *double stimulation is not a one-off engagement process but rather a sustained change process requiring patience and dedication.* Patience and considerable time are needed to develop potentially transforming and transformative climate change adaptation frameworks and plans.

Several contradictions, opportunities and 'inward' learnings also emerged in this work for the research team, including City actors who were part of the team. One of the main challenges that emerged is the challenge to one's own political value system and beliefs and what type of 'political context' can be considered for climate action planning going forward in the City. At the commencement of the project, the City's leadership changed from the African National Congress (ANC) to the Democratic Alliance led coalition government and more recently has changed back to the ANC. These changes in leadership did not only bring with them changes in political paradigms and leadership styles, but also the attention given to climate change (Figure 6) over time.

The political drivers of change in the CoJ, as with any City, are also very contested. As others have noted (e.g. Hetz⁵⁵), the tasks of bolstering economic growth and yet also attending to socio-spatial disparities in

the City, are dilemmas for the City in both deciding future development trajectories and how the City responds to climate stresses:

In Johannesburg, the operational response space for climate adaptation is likely to be determined by the ways adaptation practices can be synergised with the pressing planning challenges of the urban divide, and how, accordingly, adaptation practices gain political legitimisation in reference to society's expectations about planning outcomes.^{55(p.1176)}

Another significant contradiction that the research team and the City is facing is that linked to the time horizons for planning and how climate change actions are currently being perceived and considered. Despite the focus on a resilient, sustainable and a livable city as expressed in the City's Growth and Development Strategy 2040, climate change '...responsiveness to planning is not a priority criterion'^{55(p.1176)}. In this respect, officials repeatedly emphasised the absence of a long-term strategic vision tied to climate change as a significant obstacle for climate change appearing on project radars, with traditional employee performance measures reinforcing this (Figure 6).

One possible reason for the lack of an 'adaptation focus' and a focus that is more structurally orientated and transgressive³³ is that of time scale. Undertaking a more proactive approach, with a longer-term adaptation planning view, is often circumvented by a focus on short-termism, political cycles, and projects that produce highly visible outcomes such as the current focus on service delivery.⁵⁵ Similarly, work done by Polk⁶ has indicated that tensions, obstacles and perceived delays in generative processes that typify co-designed research and practice, may cause already over-burdened participants to revert to familiar roles and 'ways of doing'. The research team are anticipating that now that the CAP has been launched and implementation has begun, new kinds of challenges are also going to arise and require the continuation of the expansive learning journey towards embedding the new CAP into the everyday practice of the wider CoJ. Patience and trust building are thus required in such a mutually engaged process and learning to ensure commitment to longer-term, slower-to-deliver outcomes.

The way officials are rewarded through their operational 'score cards' thus can also frustrate ongoing processes that are not suitable for the types of reflexive learning process we were collectively trying to share. The KPIs and siloed approaches in the City encourage a more compliance management style (e.g. ticking boxes) rather than a more open, experimental and social learning approach. The ways in which the City is administered, both bureaucratically and financially, present challenges. Finances are allocated, released and aligned according to capital budgets (e.g. through the Johannesburg Strategic Infrastructure Platform). Budget cycles also constrain longer, more generative processes that may be required for effective climate change adaptation 'learning', as cycles tend to be short and highly competitive. Consideration of how budgets are allocated and ways to support those with capacity constraints is '... an important step to specifically addressing environmental risks via infrastructure planning'^{55(p.1177)}, as for example, a gap of about '... 500 mill ZAR capital budget for the proposed storm water projects exists'^{55(p.1178)}. These challenges are exacerbated by various issues related to the management and day-to-day running of departments and related activities (Figures 5 and 6).

Finally, more personal reflections and challenges that emerged in both the research team and some of the City officials, were coupled to the tension of wanting to profile climate change and yet also wanting to ensure that climate change actions were embedded in the mainstream without detracting from current, urgent developmental planning in the City. One is very mindful that a climate justice dimension is critical in all such climate change work and that *much* more engagement with citizens is needed. Related to climate justice, one constantly questions one's own position in such work – the concerns, for example, about inter-generational climate justice. Is the goal to move towards reducing the impacts of climate change now through the design of a climate change adaptation plan, or should the planning be more generative, that is what

may be required *now* so that we can all 'live' with climate change in the future? Perhaps the focus should instead be on immediate 'matters of concern' such as water, food, shelter and energy security in the now, hoping that some spin-offs may emerge in the future for longer-term climate change adaptation? City officials, thus repeatedly, noted existing service delivery challenges, urbanisation and a growing population associated with influxes to the City as current departmental operational responsibilities (Figure 5), and a perception that responding to climate change is, very often, disconnected from day-to-day operations (Figure 6). Taylor et al.^{56(p.106)} also noted similar tensions in their work on three municipalities in the country:

... adaptation progress to date has been reliant on coupling the climate change agenda with a dominant, pre-existing local development priority, such as market competitiveness, job creation or water security. However, when the climate change agenda conflicts with a local development priority, for example making land available for property development, it is actively marginalised, suggesting that municipal adaptation to date is limited to building resilience within traditional patterns of economic inequality and political marginalization.

Conclusions

Cities are arguably becoming the new locus of climate change action as people move to cities for work, shelter, food and overall well-being. Cities such as Johannesburg that have emerged from past planning actions based on apartheid planning modes and are increasingly being characterised by complex informality, have highlighted that the old ways of planning may not always be fit for purpose for a city that is constantly changing. Moreover, the power differentials in cities are also notable, particularly in this case where politics, leadership and development challenges changed several times as the research progressed.

Navigating respectfully, humbly, and honestly in such a complex environment thus requires the consideration and experimentation of different approaches and methods. We chose to make use of the CHAT approach here, where the basic unit of analysis, the city climate change adaptation planning actions, provided the minimal meaningful context for understanding human action. Through the CCAF and CAP, the *object-oriented activity system*, a heterogeneous, co-engaged and multi-voiced process was enabled.^{29,30} The activity system brought together the focal unit and, more critically, its social relations in a broader system (surfaced through various engagements such as Change Laboratories and smaller group interviews). In this manner, the focal unit is, and was, not seen as separate from its activities in the system, but rather was, and still is, being understood within the context and its' society/ies.³¹

Our engagements with the CoJ, as traced in Figure 4 and Table 1, were thus linked to the CHAT approach and were also strongly anchored on expansive learning processes. The four epistemic learning actions of *Questioning, Analysis, Modelling* and *Examining the new Model* were followed that have now culminated in the CAP now officially launched. The engagement of C40 through a legitimate process engaging official partners in the CoJ climate action efforts, has also given added impetus to the work we started as adaptation work in the CoJ some years ago. Several issues that we raised in our research have been taken up in the CAP. Planning action areas (over short- and long-term time scales) identified through co-designed collaborative efforts between departments have been adopted by the CAP process and further developed.²⁶ The beginnings of a detailed vulnerability assessment, reviewed by the research team and City officials, has also paved the way for more intensive and extensive development of vulnerability assessments that focus on social-economic, socio-cultural and biophysical hazard assessment.²⁶

Several learnings, both those that are more academic and those that are more personal and reflexive, have also emerged from this work for all involved, including City officials and the academic members of the team.



The most important has been the need for a respectful, trust-building approach that is intentionally both mindful and respectful of the context in which people find themselves, both as citizens living in the City and as City officials charged with managing the City.

The 'multi-voicedness' that the CHAT approach fosters, has and continues to be especially pertinent for our work with the City – allowing us to explicitly recognise the multiple points of view and interests (both individual and collective), and the diverse histories, rules and conventions operating across the CoJ community. These voices and the eyes through which the 'system' is viewed, all set the landscape for both contradictions *and* opportunities to surface in the interactions between the different actors in the CoJ, 'demanding actions of translation and negotiation'³⁷(pg.136) to facilitate shared understandings.

The implementation of the 'model solution', i.e. the CCAF and its capturing within the CAP, does not mark the end of resolving the contradictions nor probing the structural tensions that may persist when attempting to implement the City's adaption response. Rather, in fact, it marks the beginning of the emergence of *new* challenges and contradictions that arise from integrating the new solution. One of the main limitations of the study is that stakeholders such as residence associations and councillors who are affected by the City's service delivery, and the consequences of climate change impact, did not participate in the research. Their participation would have surfaced tensions and matters of concern from an 'outside' perspective, and thus, enriched both the scope and depth of the research, but also the key issues captured in the CCAF. To some extent, the absence of these voices, in particular the youth, has been remedied through the recent direct inputs into the CAP, but gaps remain. With the CAP, the City now is planning to engage on more varied actor engagements across the CoJ community.

The experiences profiled in this paper have all enabled the development of a fairly progressive CAP. The implementation of any Plan (in this case the CAP specifically) will, however, require ongoing and sustained engagement. The City and the research team remain committed to further expanding our learning so that a just and climate 'friendly' city can be handed down through the next generations.

Acknowledgements

The research team is very grateful for the time and trust gained engaging and working with the City of Johannesburg. The support and leadership actions of Lebo Molefe and her team have been, and will continue to be, extremely important as we continue to engage with the City on climate change matters of concern. We thank the anonymous reviewers for their inputs and comments that substantially improved the paper.

Competing interests

We have no competing interests to declare.

Authors' contributions

C.V.: Project leadership, conceptualisation, methodology, data collection, writing – the initial draft, funding acquisition, project management. M.M.: Conceptualisation, methodology, writing – the initial draft. K.C.: Data collection, writing – the initial draft. M.G.: Conceptualisation, funding acquisition, networking and data collection.

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