Case Study of Urban Climate Transition in Kampala City Uganda

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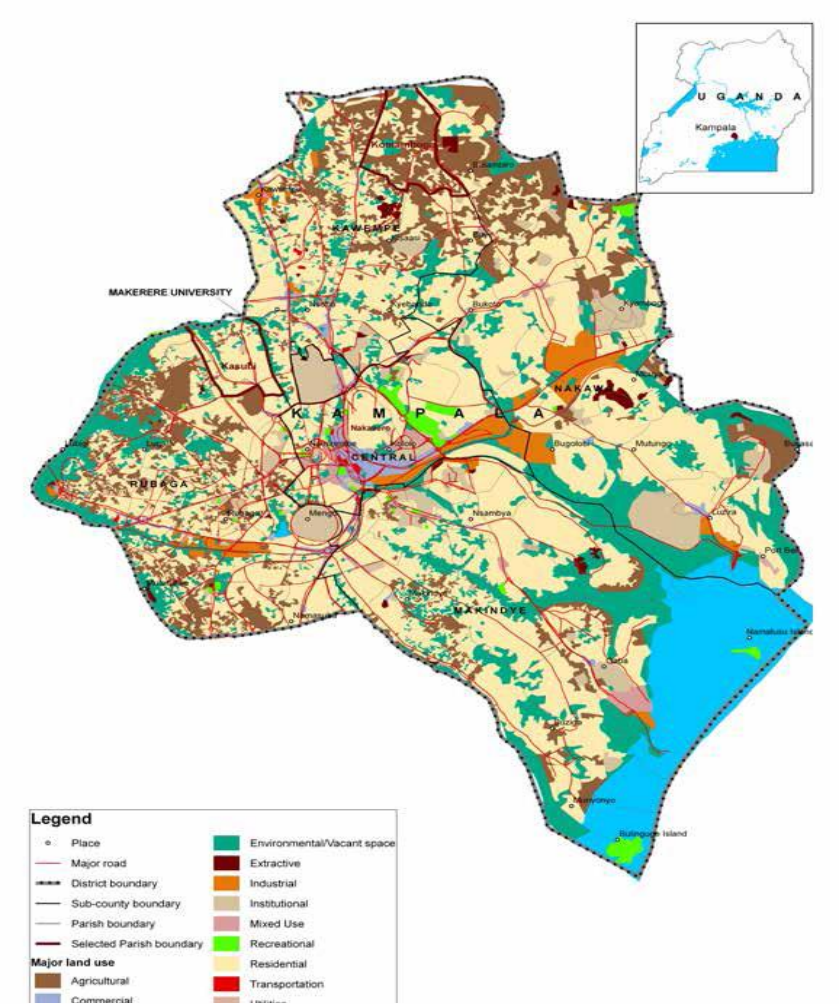
Abstract

How are cities in fragile ecological system are spatially planned, is the main theme of this paper as major theme of Urban climate transition (UTC). To get clear indices: housing and transport are exclusively studied. Kampala City uniqueness with its massive shoreline, along the second largest freshwater Lake Victoria in the world, is a cause to worry about as some of the streams and river drains out the city suburbs into the lake, bring huge amount solid waste and other pollutants into the lake that is majorly the main source of drinking water for the city dwellers. How the associated concerns are resolved, and required changes in political views, are discussed. But also, to generate technical know-how pathways in ecological as opposed to civil engineering to resolve the current physical and social generated urban-environment problems.

Introduction

Land use in Kampala 2010



Source: KCCA (2005)

Kampala Capital city is located on the shore of Lake Victoria. It has an estimated population of five to seven million people projected to be over 10 million by 2030. Kampala topology is a fragile eco-system of hills and valleys stretching 25 kilometres in radius. The City is drained with subterranean, surface streams and rivers that feed Lake Victoria and also drain through the country side. Sadly, some of the river systems have been turned into storm and wastewater drainage and canals delivering to the lake million tonnes of urban waste endangering city drinking water, poisoning the marine ecology and water resources.

Case Study

The thematic areas below are the composition of Kampala Climate Change Program. These are Kampala City Urban Climate Transition programs composed of Kampala Climate Change Action strategy 2016. It prioritises ten key sectors namely;

1. Energy efficiency
2. Waste and wastewater

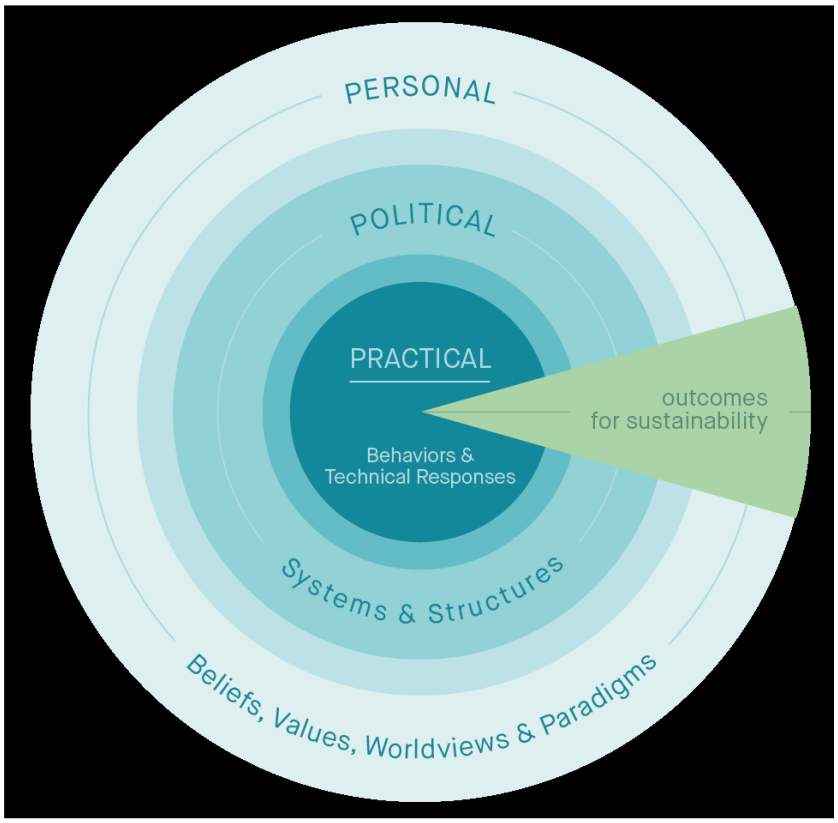
3. Mobility
4. Buildings and Land use
5. Renewable energies
6. Biodiversity
7. Green Procurement and Investment
8. Research and Innovation
9. Communication and Participation
10. Financing and Project support

This paper therefore will analyse the climate change action strategy as Kampala City case study in comparison with what had been done elsewhere.

Overview

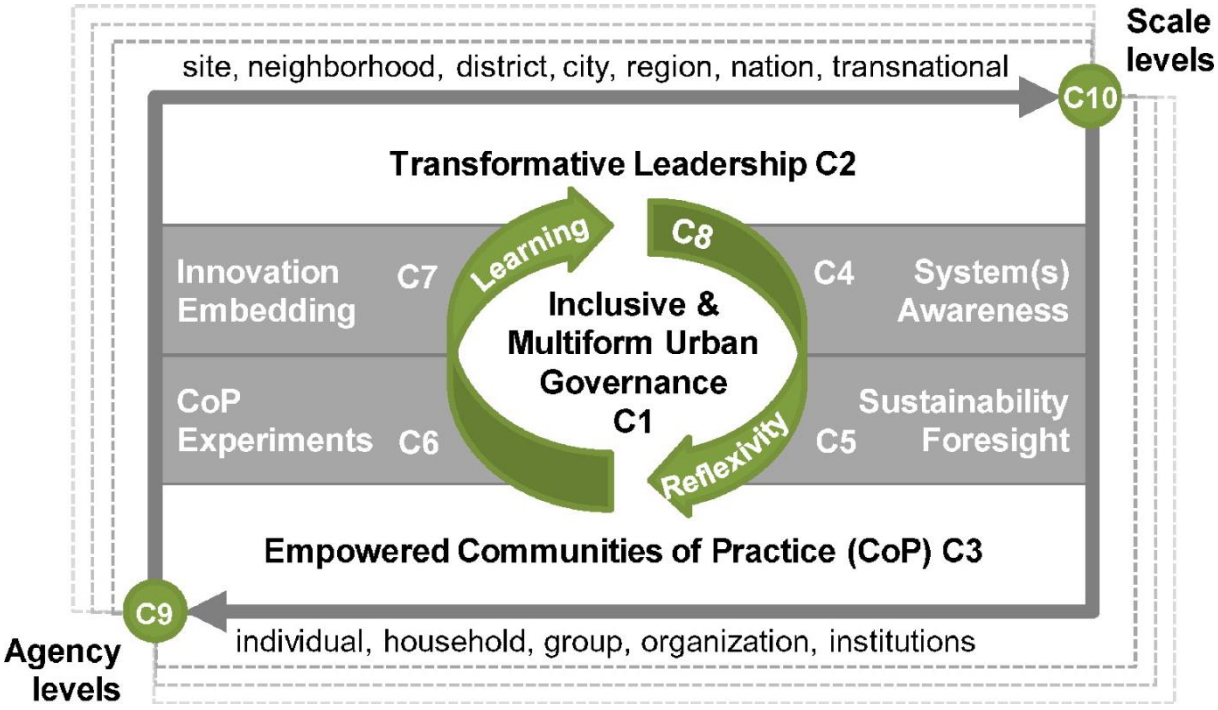
The paper focuses on: transport, buildings and housing thematic areas. The selection of the thematic areas is because they act as drivers or pathways in the development of related thematic areas i.e., land use planning, health, renewable energies, energy efficiency, waste and wastewater management and biodiversity.
The implementation of Kampala City program will depend on a well-defined program that taps into Sharma's three spheres of transformation (O'Brien and Sygna, 2013. pg.5), M. Wolfram graphic representation in Wolfrom Cities 51 (2016: pg. 126), Glaas and Mattias 2018) UCT process progression and Cynthia Five action pathways (Cynthia Rosenzweig and William Solecki, 2018). These will be weighed against Kamala Capital City Climate Change Action Strategy.
Within the literature above, important barriers and enablers to transformational pathways are examined. O'Brien et al., lines three spheres relevant to Kampala Climate Change program. It has a behavioural and technical solution (political sphere) to climate change (O'Brien and Sygna, 2013 pg.4) within the observable and measurable influence on climate policy goals such as: mitigation, adaptation, innovation etc., for sustainable development to meet the required standards.

Three Spheres of Transformation



Source: The three spheres of transformation (Sharma, 2007: pg. 20, Karen O'Brien and Linda Sygna)

In Kampala City's case, practical transformation of systems and structures that define the constraints and possibilities are underdeveloped. Kampala Capital City governance structures for: economic, political, legal, social, financing, and cultural systems need synchronising to respond to Urban Climate transitions (O'Brien and Sygna, 2013. pg. 6).
Individual and collective beliefs, values need to adjust so that people and communities can see the systems and structures in which they live in new ways. Communities are carriers of mitigation and adaptation measures.
Mapping it on Wolfram framework is essential in identifying the 10 interdependent key components (C1–C10) of urban climate transformative capacities. Wolfram writes that C1–C3 refer to agency and interaction forms, C4–C8 identify core development processes, and C9–C10 represent relational dimensions that affect all other components. (Wolfram / Cities 51, 2016: pg. 126)



Source: M. Wolfram / Cities 51, (2016)

The above structure will close the gap between the politicians (leaders), innovators, the people, and their communities. Kampala city program has also identified specific programs in each sector (pg-32-37) that in that can be marched with work Wolfram frame above.

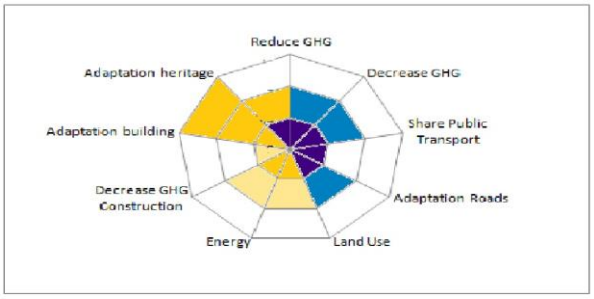
Kampala City is faced with increasing flood risks. It requires altering of the current system from regulatory, legislative, or bureaucratic regimes; financial institutions; and technological or biological systems (IPCC, 2012: 564: O'Brien and Sygna, 2013 pg 1.) to focus on the climate program as a new urban planning road map. It is critical to introduce ecological engineering into civil engineering works (Bergen et al, 2001) as a means of understanding Kampala urban hydrological, flora, and ecological systems.

Human resource training, utility innovation, innovative governance and government enforcement regimes on all social strata should be involved in climate managerial and technical know-how to trigger transformative pathways as outlined in (Calvin et al., 2009; Thomson et al., 2011: O'Brien and Sygna, 2013 pg. 2).

National Environment Management Authority (NEMA ACT, 2019) so often frustrated by politicians need to change its operation model, to be able to enforce environment laws (see O'Brien and Sygna, 2013). Combined with transformational pathways (Rosenzweig and Solecki, 2018) will stop piece meal adaptation and mitigations. The gap between development, climate change needs and politicians understanding of climate change objectives and opportunities is behavioural (Siegel, 2007; O'Brien and Sygna, 2013 pg 3). Yet still NEMA will have to work with city authorities and innovators to develop innovative urban infrastructure (see Shin (5) 2009, pp. 515–526) while reducing building urban environment and infrastructure complexity (see Edoardo 53 (2012) 9 – 15). Frequent cloudburst has caused massive city flooding amplifying the relationship between climate change compliancy and economic development. Politicians have paid a lip service to make

UCT project systematic, integrated and fully implemented in a determined time-period as recommended by climate and planning experts. Politicians have to be part of awareness-raising, prioritising and mainstreaming climate change adaptation and mitigation measures. Climate Change policies have to be designed to fit business models associated with key transformative and transition schematic areas. The government has to give local enterprises incentives to offer services and goods that meet climate change transition needs. These could be in collaborative research (see Rosenzweig and Solecki 2018, pg 757-758), low tax incentives on climate services, goods and regulate emerging enterprises in climate change sectors.

An overview of current mitigation and adaptation work and challenges in Kampala



Scaling Graphic Representation; (see also Glaas and Mattias 2018 Table S4.)

Rosenzweig and William (2018: pg. 754–761), identifies integrated mitigation and adaptation; coordinate risk reduction and climate adaptation; co-generated risk information; focus on disadvantaged populations; and improve governance and knowledge networks as key pathways to mitigation and adaptation.
Kampala climate program tabulated specific action programs on the above ten schematic areas subdivided into implementable projects (Kampala Climate Change action strategy, 2016 pg 32-38) need strengthening.
Kampala Capital City is in process of enforcing several mitigation urban climate transitions measures. Integrated detail neighbourhood plans will create new land use patterns, efficient buildings and green spaces. Contributing to proper management of floods, urban transport system, utility infrastructure planning and waste management disposal. Kampala metro master plans geared to reduce the number of vehicles in the city by phasing out of Toyota 14-seater mini-buses with high density electric seater buses now being manufactured in Uganda. Railway transport was launched in February 2018. This too will reduce high volatile

carbon compound pollution which is determined to be 92% of values being >25 _g/m3 (Okello et al, 2020) and emissions in Greater Kampala Metro Area projected to increase from 6.9 million tons in 2014 to 9.1 million tones CO2 eq. in 2020 and 14.6 million in 2030. The overall emissions will increase by 55% from 2020 – 2030 (KCCA, 2016) in the city, bringing about safety and unhealthy working environment for city dwellers if nothing is done now to rectify pollution sources.

Identified Key challenges;

The key challenges for Urban Climate Transition in this paper focus on transport, buildings, and housing. Reference is made to Wolfram's (2016: pg. 128) Urban Transformative Capacity components that have directly enable UTC. Kampala City case study focus on C1–C3 referred to as agency and interaction forms, C4–C8 identification of core development processes, and C9–C10 representation of relational dimensions that this paper assumes have a direct affect on all other thematic areas.
Kampala is a sprawling city. Unplanned human settlements generate key challenges in providing adequate transport; mobility infrastructure, utility provisions, and housing (see Glaas and Mattias 2018 Table S4.). High transport cost forces low-income earners to move nearer to the city generating slums and other related sectors that generate environmental negative impacts (Fatone et al, 2016) such domestic waste, congestion, a habitat lose.

The paper therefore has indentified key challenges based on the above two thematic areas: transport and housing.

1. There is need for low-cost housing to optimize waste management and mobility.
2. Lost cost Housing decrease emissions, adaptation of buildings and information. Private and public house owners require professional, and expert coordinated research in housing: sociology, economics, construction and ecological engineering and architecture.
3. Ecological Land Use planning that promotes biodiversity. This challenge too requires coordinated research in landscape architecture and ecology engineering. Uganda doesn’t have professionals in those sectors.
4. Kampala City needs multimodal mobility and transport system currently constrained by lack of totally covering infrastructure for cycling lanes for school children, low-income earners, and people with disabilities. Uganda has less than 15 transport engineers, economist and planners all combined.
5. Transition from fossil fuels transport system and homes to reduce GhG in both sectors.

Health issues associated with the above challenges are on the raise and need to be expeditiously resolved by reducing GhG from cooking fuel, phasing out diesel mini-buses and exercising for people now affected with non-communicable diseases necessitating expeditious implementation of transformational pathways. (Rosenzweig and Solecki, 2018: pg. 757)
Recommended responses and how they should be included in the strategic plan for Kampala City. Arguments why urban climate transition is needed in your city;

The city like Kampala in a Lake Victoria wetland, and lake shores should have a Strategic Urban Climate Transitions (UCT) as its basic philosophy- "politics of the possible" (Swyngedouw, 2010; O'Brien and Sygna, 2013 pg 4.). The city procurement has to be aligned to UCT. The city should attract international collaboration in urban climate research and continuous study, evaluation and monitoring of the agreed programs and also have a platform where the above can be debated and discussed.

The most urgent recommendation will be establishment of Urban Living labs (Bulkeley et al., 2019) based model villages (Peter Headicar: Hugh Barton et. al., 2015:221). with small community homes that have improved off-grid wastewater, storm water handling systems and household garbage management facilities. Organised human settlements should be prioritised, where given services can cheaply be provided like water, electricity, cooking gas distribution network and sewerage system. It requires urban design and development where community housing can be provided instead of detached or semidetached homes spreading horizontally. From a transport and mobility sector, majority city dwellers are low-income earners that need to have better accessibility to their homes, schools and working places. The fact augments improvement of environment safety and health laws from accidents, crime, affordable transport cost, and better economic preconditions.

Overall urban climate transition has to be integrated i.e., resettlement of urban slum population from fragile eco system to organized human settlement where mitigation measures can serve the collective instead of some spatially scattered communities as it is today. That too implies having transport system as a driver to integration of other thematic areas; the health sector, housing, environment, biodiversity, economic sustainability etc. Glass and Mattias, 2018).

KCCA should establish collaborative research in urban climate transition. This will systematically guide current short falls in how the programs are initiated, through multiple model application via urban living labs (Bulkeley et al., 2019), prototyping, elimination of undesired effects and impacts and finding areas to scale up where the program work well. (Rosenzweig and Solecki, 2018: pg.758) Bringing in many business enterprises will make the program more effective. Uganda metrological authority, Kampala Capital City authority and international research and production entities should join hands to find better ways of make UCT a reality. One entity is not enough to deliver and scale up UCT, transport, housing, health and other thematic areas that might need a far more specialised professional expert input.

Motivating the identified key challenges and why proposed responses are needed for Kampala city;

Kampala Structure Plan, 1994. (Source: Plan alliance, 2009).

There is institutional and governance systems on a village level that lack direction and development philosophy that should shape and determine the development pathways (Rosenzweig and Solecki, 2018) for Kampala City climate change strategies. Human settlements in Kampala City have a horizontal expansion. This is unsustainable since land is fixed whereas the population is rapidly expanding. Basic principals and problems associated with an unplanned city, specifically unplanned human settlement and transport infrastructure impact on the environment and climate should clearly be outlined.

Green transport systems and networks, integrate homes with working places; schools and hospitals, act as drivers to transformational pathways. In the table below, Glass and Mattias 2018 have created a score card for those two schemes. Improved health, waste management, and clean energy are integral into this score card. However, this will have to be collected with Smith, Geels's observation that there is no single cause or driver for niche transitions (Smith, 2010; Geels, 2011; O'Brien and Sygna 2013. pg.3) necessitating constant renewal, research, innovation and development.

UCT activity	Initiation (inner circles)	S1	Innovating (middle circles)	S2	Scaling-up (outer circles)	S3
Transport						
7. Reduce GHG emissions from passenger transports.	**Goal:** Decrease CO_2 emissions with 40% by 2020 compared to 1990 **Goal**: reduce energy consumption by 20-40% Restrictions on importation and use of second hand vehicles estimated to reduce energy consumption by 25-30% **Investigation:** GKMA level are projected to increase from 6.9 million tons in 2014 to 9.1 million tones CO_2 eq. in 2020 and 14.6 million in 2030	**2**	**Response** : Implementing new BRT **Experiment:** Installed charging stations for electric buses Planned: Railway extension with trams and buses mix for mass transport	**1**		**0**

8. Decrease GHG emissions from goods transports	**Goal**: green contributing sectors include transport, household, freight, waste, tertiary and industrial sectors.	2		1		0
9. Increase the share of public transportation, railway, buses, biking and walking	**Goal :** Assess possibilities to increase public transportation, biking and walking city dwellers **Goal**: Plan make biking, walking and public transportation more attractive **Goal:** Increase public transports **Plan:** Build more walking and cycling lanes	2	**Response:** Building new/developing walking and biking routes and new traffic signs **Implementation:** Municipal employees can try bus cars **Service:** information campaigns on biking	2		0
10. Adaptation of roads and transport infrastructure	**Goal:** Improve a mix of Mobility Modes	2	**Response**: Greater Metro Transport system with a mix of transport modes	1		0
Building and housing						
11. Support sustainable land use through urban densification	**Goal:** Increase affordable housing via PPP and financing.	2	**Response:** More state agencies are scaling up home provisions for teachers, medical worker, police officers, students	1		0
12. Increase energy efficiency in buildings	**Goal:** To move people from slum to compact cities **Investigation:** Provide free mix of electricity sources	2	**Response**: Increase public home investment through public and private means :	1		0
13. Decrease emissions from constructions		0		0		0
14. Adaptation of official buildings and information to private house owners	**Goal:** Ensure reliable electricity to Community- **Investigation**: Government has a power extension program	2	Response; both for land use planning , taxation	1		0
15. Adaptation of cultural heritage (e.g. buildings with cultural values)	**Goal:** Preservation of cultural land marks	2	**Response**: Identified, published and gazetted	2		2

Source: ***Ambio*** Electronic Supplementary Material (ESM) (Erik, Mattias et al., 2018)

The score card above is science in time and in place for monitoring and evaluation of mitigation measures (Rosenzweig and Solecki, 2018) alluded to above. The Social economic environment can also be improved with simple social ecological system and social technical system (Wolfram, 2016). The city population is generating huge amounts of biodegradable waste that can be used for generating cheap electricity and fertilisers for households. Cooperative structures can be initiated to improve on the built environment.

Kampala City as a developing urban area has a huge amount of resources for income generation to boost its revenues sources (Rosenzweig and Solecki, 2018: pg. 757). There is need for mobilisation and governance system to bring these resources to fund investment in homes, commercial and industrial buildings for the poor, setting up early warning system that should be based on adequate knowledge of the problem, compelling institutions to perform and act on climate issues, and mobilising the informal sector to utilise the limited resources. Uganda has not had an adequate rational planning system-based analysis based on land use principals.

A forward-looking reasoning about the prospects for urban climate transition in Kampala city. (capacities, drivers, barriers)

Kampala City Transformability should be based on Westley et al., (2011: 763): O'Brien and Sygna, (2013. pg.1) as the capacity to create untried beginnings for urban new ways of living where current ecological, economic, and social conditions make the current system untenable. Luckily enough, Kampala is still and qualified urban village where new methods of spatial planning are still possible.

Kampala Capital City needs a climate development doctrine with enabling conditions such as financing, governance capacity and social norms and practices, as well as a broader set of physical, human poverty, consumption, and population growth limits. (Rosenzweig and Solecki, (2018 pg 756). These capacities drive sustainable development in the ten schematic fields. Orientation and practical guidance for urban planning and design learning from nature can also act as a driver on a village level that will take into considerations sustainability innovations, technological, experimentation and flexibility mentioned by Wolfram and Frantzeskaki, (2016) i.e., in urban fuel use, waste management, flood mitigation and energy consumption.

Kampala City could march its scorecard with Integrate mitigation and adaptation, coordinate disaster risk reduction and climate change adaptation co-generate risk information, focus on disadvantaged populations in slums, local council governance, and finance and knowledge networks platforms. (Rosenzweig and Solecki, 2018)

Kampala Capital City can afford a greener transport system. The city has a radial road network, cutting across the city. Combined with buses, cycling and pedestrian lanes mobility system servicing Kampala urban districts will offer an easy access to all parts of the city.

Conclusion

Green human settlements, governance culture (O'Brien and Sygna, 2013), transport infrastructure and urban road redesigning that complies with climate requirements will offset the much-needed transformational pathways, if densification interventions are based on water, soil, energy, electromagnetism, seismic, public facilities, waste, mobility, noise, air arrays. (Fatone, et al 2016). Green transport system should be the driver not a barrier to set off the science in Glaas and Hjerpe, (2018) and action pathways (Rosenzweig and Solecki, 2018) for transforming cities to urban climate transitions in the schematic matrix.

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