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# Mainstreaming Climate Change Adaptation Planning in City's Master Plans (A Critical Review)

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## *Abstract*

Climate change and its impacts continue to affect urban areas globally. Apparently, despite the existence of international, regional, and national climate change development policies, city authorities in low and middle-income countries are daunting consideration of climate change in their undertakings. This paper explores mainstreaming climate change adaptation planning in the city's master plans of low and middle-income developing countries in sub-Saharan Africa. Specifically, the paper assesses the extent of integrating climate change adaptation planning in the city's development planning process. Results indicate that city authorities have not adequately considered climate change in their planning processes because of multiple factors including institutional, financial, and technical capacity which seem to jeopardize long-term resilience to climate change impacts.

***Keywords:*** *Mainstreaming Climate Change; Adaptation Planning; City's Master Plan; Tanzania*

## *1. Introduction*

Climate change and its impacts continue to affect urban areas globally (IPCC, 2014). The current world population is approximately 7.9 billion people[1] in which by 2050 66 percent of this population will be living in urban areas (Williams et al., 2019). More than 90 percent of this urban population growth escalated by a high fertility rate will take place in cities and towns of the global south in Africa, Asia, Latin America, and the Caribbean (UNFCCC, 2018). Urban areas in low- and middle-income countries are associated with urban informality indicated by inadequate basic infrastructure services including water, sanitation, electricity, security of tenure and shelter in perceived informal settlements which

[1] https://www.worldometers.info/world-population/ accessed on 25 August 2021 at 9:20EAT.

accounts for 60 to 80 percent (Müller, 2017; Pauleit et al., 2015; Richmond et al., 2018; Sandoval et al., 2019). During climate change, these challenges are exacerbated and make urban areas more vulnerable to climate change impacts (Živković, 2019).

Urban climate change is unequivocally influenced by human activities including energy consumption for cooking, heating, transportation and industrial production activities in urban areas (Masson-Delmotte et al., 2021). The IPCC AR6 indicate that the climate system components including the cryosphere, atmosphere, biosphere and oceans have warmed due to human influences on it (IPCC, 2014; Masson-Delmotte et al., 2021). Climate change impacts includes extremely temperatures which results into urban heat island (UHI) effects, urban flooding, sea level rise and coastal erosion are good indicators of climate change in urban areas (UN-Habitat, 2014).

Despite the vulnerability of urban areas to climate change yet mainstreaming of climate change in low- and middle-income countries especially in Sub-Saharan Africa is inadequately undertaken (UN-Habitat, 2014). In Sub-Saharan Africa, climate change impacts have affected urban areas mostly because climate change seems not to be mainstreamed in the general spatial plans (IPCC, 2014; Pauleit et al., 2015; Reda & Tripathi, 2011; Salami et al., 2017).

## 2. *Methodology*

### 2.1 Location

Tanzania is located at the East Coast of Africa between latitudes 1º South and 12º South and between longitudes 29º East and 41º East (Figure 1). It extends from Lake Tanganyika in the West to the Indian Ocean in the East, Lake Victoria in the North, Lake Nyasa and River Ruvuma in the South. Tanzania shares the borders with Kenya and Uganda to the North, Rwanda, Burundi, Democratic Republic of Congo and Zambia to the West, Malawi and Mozambique to the South. The total area of Tanzania is 945,087 square kilometers, of which the mainland comprises of 939,702 square kilometers and the islands of Zanzibar, in the Indian Ocean, comprise of 2,654 square kilometers. Tanzania mainland is dominated by large central plateaus covered with grasslands, plains and rolling hills. The Serengeti Plain is a large geographical area that spans some 30,000 km2. The country has some belts of highlands including Mount Meru (4,566 m above mean sea-level), Mount Kilimanjaro (5,895m above mean sea-level)-the highest Mountain in Africa, and other mountain ranges such as Livingstone, Kipengere, Udzungwa, Uluguru, Nguu, Usambara and Pare (URT, 2021).

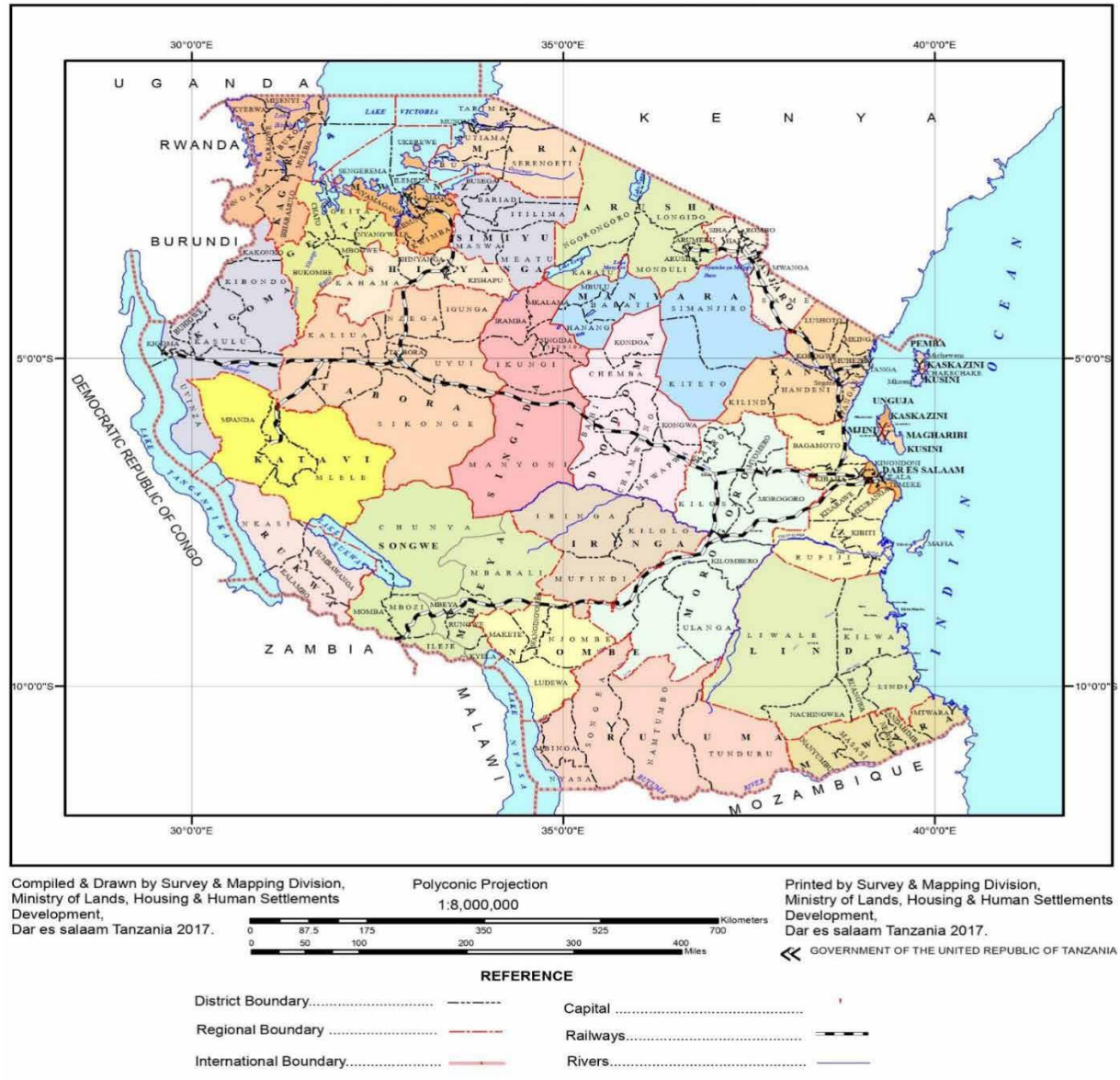


Figure 1: The Map of the United Republic of Tanzania showing Administrative Boundaries. **Source:** URT, 2021.

### *2.2 Materials and Methods*

This paper adopted literature review. The study reviewed urban development policies from other countries and city's master plans of Dodoma, Mbeya, Mwanza and Arusha in Tanzania. The main objective was to assess the extent of mainstreaming climate change adaptation planning in city's master plans. The general findings revealed that local planning authorities have inadequately mainstreamed climate change. The main reasons for inadequate mainstreaming climate change adaptation in city's master plans involve multiple factors including institutional, financial and technical capacity which jeopardize long-term resilience to climate change impacts.

## *3. Results and Discussion*

### 3.1 Theoretical Framework for Mainstreaming Climate Change Adaptation Planning in Urban Development Policies, Plans and Programmes

Mainstreaming climate change adaptation planning in urban development policies, plans and programmes is associated with various theories including those related to mainstreaming, climate change and urban planning as briefly described below.

#### 3.1.1 The Theories in Climate Change

The theories of climate change are basically concerning with the major causes of climate change and its impacts to the climate system (Trenberth et al., 1996). The theories postulates that, the climate system is an interactive system composes of five components namely the atmosphere, the biosphere, the hydrosphere, the cryosphere and the lisosphere or land surface, forced or influenced by various external forcing mechanisms, the most important of which is the sun (Trenberth *et al.,* 1996). The sun transmits ultraviolet light to the earth surface whereby some radiations are absorbed by the earth surface and becomes warmer while others are reflected back to the atmosphere and absorbs greenhouse gases mainly carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride emitted from various human activities including land use change and burning of fossil fuels as energy sources for urban transportation and industrial processes and product uses (IPCC AR6, 2021). Bast and UNU-WIDER provides theories of the major causes of climate change as in climate change as Anthropogenic Global Warming (AGW), Bio-Thermostat Theory**,** Cloud Formation and Albedo**,** Human Forcing besides Greenhouse Gases**,** Ocean Currents and Planetary Motion (Bast, 2013). The AGW theory postulates that human induced emissions from greenhouse gases primarily of carbon dioxide (CO2), methane (CH4) and nitrous oxide (N2O) are the major causes of global warming (Bast, 2013). Bio-Thermostat Theory postulates that the negative effects from biological and chemical processes namely carbon sequestration, carbonyl sulphide, diffuse light, iodocompound, dimethyl sulphide and other aerosols entirely or almost entirely offset the positive effects of rising carbon dioxide which acts as a global bio-thermostat keeping temperatures in equilibrium. Carbon enhances the productivity of plants, thus the more there is, the better the plant will grow and hence neither carbon nor biological processes are harmful to the earth (Bast, 2013;UNU-WIDER, 2016). The Cloud Formation and Albedo theory provides that cloud formation along with greenhouse gases influences the amount of solar radiation reflected and absorbed by the earth's surface (Muller et ., 2011). Bast further points out that changes in the formation and albedo of clouds creates negative feedbacks that offset all or nearly all of the warming effect of high levels of carbon dioxide (Bast, 2013). The theory is based on It is based on observational data reported by a series of researchers rather than by computer models as in the case of AGW theory (Bast, 2013). The Human Forcing theory provides that human major influences on the climate is not its greenhouse gases emissions but its transformation of earth's surface by deforestation, urban heat island effects, jet contrails, aerosols and ozone, irrigating deserts and building cities and urban formation from population growth and coastal development (Bast, 2013; Pielke et al., 2009; UNU-WIDER, 2016). The Ocean Currents Theory provides that changes in global temperatures are highly attributed by the slowdown of the Thermohaline Circulation (Bast, 2013; UNU-WIDER, 2016). Ocean currents act as a conveyor belt that transport warm water and precipitation from the equator to the poles and cold water from the cold poles back to the tropics. In this case ocean currents help to regulate the global climate by counteracting the even distribution of solar radiation reaching Earth's surfaces UNU-WIDER, 2016). The Planetary Motion Theory provides that climate change is attributed mainly by the natural gravitational and magnetic oscillations of the solar system and these oscillations alter the solar system and influence the earth to cause climate change (Bast, 2013; UNU-WIDER, 2016). The Solar Variability theory provides that solar variability accounts for most or all of the warming in the late twentieth century

and will dominate climate in twenty-first century regardless of man-made greenhouse gases emissions (Bast, 2013; UNU-WIDER, 2016).

### 3.1.2 The Theory of Mainstreaming Climate Change

Mainstreaming is a concept that brings emerging and sectoral issues into the Centre of discussions by attracting more political attention, economic resources and intellectual capacities (Gupta, 2018). According to Picciotto, mainstreaming connotes gradual reform rather hysterical revolution achieved through incremental changes in programme goals, protocols of operations and organization culture (Picciotto, 2002). The policy evolution of mainstreaming climate change into development and development cooperation started earlier in the initial stages of climate negotiations after the adoption of the United Nations Framework Convention on Climate Change (1992) which provided for setting up a specific field of action to deal with climate change (Gupta, 2018). This arose by motivations from the various actors namely negotiators and researchers in phase 1 of 1990 which saw climate change as a standalone issue (Gupta, 2018&2010; Guzman, 2016). In the second phase towards the end of 1990s led by researchers and EU policy makers and scholars made a link with development issues and aid agencies began exploring the potential of mainstreaming climate change into development cooperation (Gupta, 2018). In the third phase led by EU, Donor agencies, EU Commission and Council, G7, World Bank, OECD, UNEP and UNEP-UNDP a policy process was launched to implement this multilateral as well as bilateral aid and mainstreaming increasingly came to be seen as good development issue (Gupta, 2018). The theory of mainstreaming climate change in sectoral development and cooperation was inevitable because the initial assessments showed that greenhouse gases were emitted from each sector and all sectors including water, food security and health were likely to be affected by the impacts of climate change and hence it was appropriate for each sector to mainstream climate change in order to mitigate and adapt to climate change impacts (Gupta, 2018). The main theoretical issues that motivated mainstreaming climate change into sectoral development and cooperation includes avoidance of policy conflicts, enhance effectiveness of climate policies in developing countries by reducing greenhouse gases emissions, reduces risks and vulnerability to climate change impacts especially greenhouse gases from sectoral development undertakings, enhance financial flows from global climate funds through adaptation and mitigation projects development, decline in domestic donor support in donor countries over the years had led to aid exhaustion and clear linkages between climate change and development and sustainable development goals in sectoral plans affected by climate change impacts (Gupta, 2018; Lebel et al., 2012).

### 3.1.3 The Modern Urban Planning Theories

The modern urban planning theories are theories which have considered current ongoing global agenda in particular the new urban agenda 2016, the Paris Agreement under UNFCCC (2015), agenda 2063 on the Future Africa We Want (2015), the Sendai framework for Disaster Risk Reduction 2015-2030 and UN 2030 sustainable development goals 11 (promoting sustainable cities and communities) and 13 (strengthening climate actions) (2015). These includes smart city, slow city, ecological city (ecocity) (Rysz & Mazurek, 2015). Both theories focus on social, economic and environmental sustainability with the target of reducing cities vulnerability to climate change impacts and reducing greenhouse gases emissions from human activities such as burning of fossil fuel for energy sources for transportation, industrial processes and product uses (UN-Habitat, 2014; IPCC AR5, 2014). The modern urban planning theories promotes shifting from conventional approaches of urban planning to inclusivity through consideration of current issues including climate change in the urban planning processes (Berke & Stevens, 2016; UN-Habitat, 2014). Conventional land use planning theories evolved in 1950s such as rational communicative theory of planning, rational-comprehensive theory of planning, the incremental approach, transformative incremental approach, the transactive approach, the advocacy approach, the

equity approach, the radical approach and the humanist or phenomenological approach which emphasized on the improvement of built environment based on spatial factors such as exposure to direct sunlight, movement of vehicular traffics, standardized housing units and proximity to green space relied on small group of technicians including architects, urban designers planners and engineers and other less common but nonetheless influential groups included were government officials, private sectors and landscape architects which failed to provide avenue for public participation for planning in which people and space were represented as value – free and objective (Timmermans et al., 2012). These theories have been criticized because of their lack of participation of the people including vulnerable groups in the planning processes and do not align with ongoing global development agenda. Henceforth a need for modern urban planning theories that foster adaptation planning for adaptive urban systems including smart city, slow city and eco-city which align with global development agenda for safe, inclusive, resilient, sustainable and equitable cities and communities have been developed (UN-Habitat, 2016; Van De Pas et al., 2016).

### 3.1.4 The Theory of Climate Adaptation Planning

Urban areas face many challenges such as many are characterized by informal settlements that lack access to basic services example water supply and sanitation, electricity, security of tenure and shelter which reach proportions of 60 percent to 80 percent (Pauleit et al., 2015). The IPCC AR5 realized that climate change impacts including increased temperatures, increased precipitation and sea level rise will continue to exist and exacerbate the already existing urban challenges (Collado et al., 2019; IPCC, 2019; UNFCCC, 2018). This call for urban adaptation to climate change theory which denotes actions undertaken to reduce the risks and capitalizes on the opportunities associated with global climate change in urban areas (Füssel, 2007; IIED, 2007). Climate change adaptation is about adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects which moderate harms or exploits beneficial opportunities (Füssel, 2007; IPCC, 2000).

### 3.1.5 Theory of Change

The theory of change (TOC) started in earlier 1950s when considerable body of theoretical and applied development in the evaluation field, especially among of the work of people including Huey Chen, Peter Rossi, Michael Quinn Patton, and Carol Weiss (Msila & Setlhako, 2013; Pringle & Thomas, 2019; Vuyisile Msila, 2012). TOC is a theory that elucidates the process of change by outlining the causal linkages in an initiative. It is a roadmap, a blueprint, an engine of change, a theory of action and more. It starts with defining the long-term goal or vision statement (the change that is needed to happen) by establishing short, intermediate and long-term outcomes that assist achieving the goal or vision. It is used for planning, participation and evaluation of government, companies, philanthropy, not for profit sectors to promote social change (Bours et al., 2014). In this study, the theory of change is useful in analysis of how change can happen in a given location, sector or social group, determine barriers and assumptions in this context which is consistent with mitigation and adaptation planning (Bours et al., 2014). TOC was used in the analysis of the causes and effects of vulnerability of urban areas to the impacts of climate change including extremely temperatures; increased precipitation and sea level rise and develop a vulnerability assessment framework that will generate climate change information that will enable urban planners to integrate climate change in urban planning during the planning process. Moreover, the TOC is used in the analysis of the causes of inadequate mainstreaming of climate change in urban planning which the study found to be inadequate capacity both technical and finance in central and local planning authorities and lack of climate change vulnerability assessment framework for mainstreaming climate change in urban planning.

### 3.1.6 Theory of Vulnerability

The theory of vulnerability is about characteristics of a person, group of people and their situations that influence their capacity to anticipate, cope with, resist and recover from the impact of natural hazards or human actions (Wisner et al., 2003). It is a combination of many factors that determine the degree to which someone's life, livelihood, property and other assets are put at risk, a distinct and identifiable event in nature and in society (Wisner et al., 2003). Depending on the vulnerability situation, some groups are more prone to damage, loss and suffering in the context of different hazards (ibid). The key variables that determine vulnerability to hazards include class in terms of wealth, occupation, caste, ethnicity, gender, disability, and health status, age, immigration status whether legal or illegal and the nature and extent of social networks (Wisner et al., 2004&2003). According to this book the term vulnerability is used to mean those who are at risk or worse end of spectrum and fail to reconstruct their livelihoods because of disasters which makes them more vulnerable to the expected events (Wisner et al., 2003). Adger and Moret also provides ideas on the theory of vulnerability by arguing that, vulnerability strongly originates in the literature for disaster management, ecology and hazards especially as related to climate change (Adger et al., 2004; Moret, 2014). The literature on hazards and vulnerability from 70s and 80s has an important influence on the broader literature on vulnerability which is divided into two schools of thought: that under the behavioral and that under the structuralism paradigm (Adger et al., 2004; Moret, 2014).

### 3.2 Experiences of Mainstreaming Climate Change Adaptation Planning from Other Countries

Mainstreaming climate change is about consideration of climate change adaptation and mitigation in existing urban development policies, plans, programmes and budgets to enhance cities resilient and mitigation of climate change induced hazards including sea level rise, extremely temperatures and increase precipitation (Gupta, 2018; Guzman, 2016). It is a process that involve climate change impacts and vulnerability assessments, identify and analyze adaptation options, identify and costs programmes and actions for climate change interventions, design and implement a plan for mainstreaming climate change adaptation in urban planning and monitor and evaluate the climate change adaptation mainstreaming implementation process (UNDP, 2012; UNEP, 2011). The IPCC AR5 recognizes the importance of mainstreaming climate change in urban development policies, plans and programmes to enhance resilience of urban areas to the adverse impacts of climate change and mitigation of greenhouse gases emissions (IPCC AR5, 2014; Wijaya et al., 2020). Low- and middle-income countries are at different stages of mainstreaming climate change adaptation planning (UNDP-UNEP, 2011; ICLEI, 2012). Some are at the level of stakeholders involvement and participation while others are at the level of undertaking vulnerability assessment, analysis of current and future impacts, assessment of adaptation options, implementation of adaptation opions and monitoring and review (UN-Habitat, 2014; JoAnn et al., 2012). In this regard, mainstreaming climate change adaptation planning in urban development policies, plans and programmes is of paramount importance towards for inclusive, resilient and sustainability of cities and communities in urban areas against the adverse impacts caused by climate change.

### 3.3 Mainstreaming Climate Change Adaptation Planning in Indonesia

Indonesia is an archipelagic state vulnerable to climate change impacts especially sea level rise, increased salinity because of sea water intrusion into freshwater resources and acquirers and coastal flooding (Wijaya et al.,2020). The impacts of climate change are felt much at the local level due to inadequate knowledge on climate change and associated impacts by local communities (ibid). A study on Drivers and Benefits on Integrating Climate Adaptation Measures into Urban Development:

Experiences from Coastal Cities of Indonesia in the coastal cities of Semarang and Bandar Lampung found that these cities have integrated climate change adaptation measures at the local municipal plans because of their long-term experiences on sea level rise, coastal flooding and increased salinity (Wijaya et al.,2020). The two cities have mainstreamed climate change adaptation measures into urban local development plans including improving resilience against climate change by combining the projection of health-related climate change and resilience with solid waste management (Bandar Lampung) for waste management and Building resilience towards watershed through the combination of technology and community participation (Semaranga) for urban disater risk reduction (ibid). The key drivers for successful implementation of the integration process in Indonesia's local municipal plans involved the government support to municipal officers technically and financially in the implementation of the climate adaptation measures in urban development plans (Wijaya et al.,2020). This enhanced the urban climate resilience development programmes at the local levels. Similarly, the benefits for climate adaptive development integration strategy are the potential of enhancing resilient, inclusive and sustainable cities and communities in the long term and ultimately achieving the UN 2030 sustainable development goals 11&13 on sustainable cities and communities and climate action respectively, agenda 2063 on the Future Africa We Want, the New Urban Agenda and the Sendai Framework on the Disaster Risk Reductions.

### 3.4 Mainstreaming Climate Change Adaptation Planning in Land Use Plans in Rwanda

The Republic of Rwanda like other developing countries in Africa is categorized as vulnerable to climate change impacts (ND-GAIN, 2015). The changes in climate pattern have made Rwanda to adjust on how the national and local governments plan prepare for climate change, henceforth, mainstreaming of climate change adaptation in some land use policies, plans, programmes and strategies. For example, in Rwanda the National Human Settlements Policy (2009) and the Land Use Planning Law (2012) has integrated climate change adaptation in particular analysis of climate change impacts and vulnerability to climate hazards especially flood prone areas during increased precipitation and discouraging people to construct housing on steep slopes so as to avoid flooding during imminent rainfall (Rwanda, 2015). However, these policies are still weak and lack substantive direction and mandates for urban planners and managers (Rwanda, 2015). The process of mainstreaming climate change adaptation in land use plans in Rwanda is undertaken by identifying the entry points such as policy levels, national levels, sector levels and implementation levels, climate change impacts and vulnerability assessment, identify and analyze adaptation options, identify and costs programmes and actions for climate change interventions, design and implement a plan for mainstreaming climate change adaptation in urban planning and monitor and evaluate the climate change adaptation mainstreaming implementation process (Rwanda, 2015; UNEP, 2011).

### 3.5 Mainstreaming Climate Change Adaptation Planning in Urban Planning in Ghana

A study on urban planning and climate change in Kumasi, Ghana found that, urban planning is blamed of its failure to influence positively climate change impacts in urban Africa and yet very little is known on private sectors or agencies policy responses on climate change in urban areas (Cobbinah et al., 2019). The literatures on the history of Ghana indicate that urban planning policies have focused on improving the well-being of people and not on consideration and recognizant of urban planning as a tool for managing climate change despite the awakening of global debates (ibid). However, in 2012 Ghana developed its urban policy framework and action plan with the goal of promoting climate change adaptation and mitigation mechanism in which several polices were developed to help to achieve the objectives of addressing climate change risks including the national climate change policy (2012) and national climate change adaptation strategy 2010 - 2020) (Cobbin et al.,2019). Its objectives inter alia is

to intensify public information and awareness campaigns on energy conservation, climate change, and mitigation strategies (ibid). The study concludes that urban planning and management is an effective tool for managing climate change and its impacts and ultimately achieving UN 2030 sustainable development goals especially goals 11 and 13 on sustainable cities and communities and strengthening climate action respectively because of its potential in creating spaces that are environmentally sustainable, socially inclusive and economically vibrant (Cobbin et al., 2019). Despite these opportunities of urban planning to play fundamental roles in managing climate change impacts still mainstreaming of climate change policies, plans and programmes have little success due to other factors including inadequate funds, lack of climate information or data, low enforcement of planning legislations, inadequate institutional and technical capacity on climate change (Kiunsi, 2012; Cobbin et al., 2012). Therefore, there is a need to enhance institutional, technical and financial capacity to enable effective mainstreaming of climate change in urban development policies, plans and programmes for resilient, inclusive and sustainable cities.

### 3.6 Mainstreaming Climate Change Adaptation Planning in Planning Structures of South Africa

South Africa has mainstreamed to some extent climate change adaptation planning in local municipal policies, plans and programmes (Pieters et al., 2020). A study on climate change adaptation mainstreaming in the planning instruments of two South African local municipalities observed that local municipal community plans have recognized the impacts of climate change on settlements and the potential role urban planning it plays on adaptation to these impacts (Pieters et al., 2020; UN-Habitat, 2014). The study was undertaken in the city of Cape Town Metropolitan Municipalities and Thulamela Local Municipalities. The selection criteria involved the municipality to have developed a climate change response plan or similar plan at either local municipal or district level, the municipality must be recognized as having undertaken climate change adaptation mainstreaming into at least their integrated development plans (IDP) and or spatial development framework (SDP) and there should be a champion (an individual or department) within the municipality that drives climate change response and adaptation (Pieters et al., 2020). The result of the study shows that Cape Town is one of the earliest municipality to mainstream climate change adaptation and mainstreaming on the municipal agenda and is one of the main economic centre in the country and face climate change impacts namely droughts, sea level rise and wildfires (Pieters et al., 2020). The Thulamela Local Municipalities climate change, risk and vulnerability are considered important issues for mainstreaming in planning instruments such as the IDP and SDF because the municipalities have not adequately considered climate change adaptation into planning instruments IDP and the SD due to poor coordination and disjointed mainstreaming in their strategic planning instruments.

### 3.7 Mainstreaming Climate Change in Urban Spatial Plans in Tanzania

Mainstreaming of climate change in urban planning of Tanzania hasn't adequately undertaken despite the fact that the central and local authorities understand the risks posed by climate change including extremely temperatures, droughts, sea level rise, increased precipitation and extreme weather episodes especially storms, cyclones and hurricanes (Irish, 2018; John, 2015). For example, the Dar es Salaam City Master Plan 2016 – 2036, Mtwara Master Plan 2015 – 2035, Dodoma City Master Plan 2029 – 2039 do not adequately integrate climate change adaptation and mitigation (URT, 2015, 2016a, 2016b, 2019). Therefore, a need arises to seek for climate change institutional vulnerability assessment framework to yield climate change information that will be used by urban planners to mainstream climate change into urban planning practices for adaptation and mitigation of climate change.

Tanzania became a low-middle income country in 2020 and is categorized as among of the

developing countries whose cities are vulnerable to climate change impacts such as extremely temperature, urban flooding, sea level rise and coastal erosion (URT, 2021). In Tanzania, about 75 percent of its people live in unplanned settlements which during climate change vulnerability this challenge is exacerbated (URT, 2016, Kombe 2017, McGranahan et al. 2020). Despite the vulnerability of Tanzania's cities to climate change impacts yet mainstreaming of climate change adaptation planning in cities development plans including the master plans is inadequately undertaken (URT, 2016). It is for this background this paper explores mainstreaming climate change adaptation planning in city's master plans of Tanzania.

Mainstreaming climate change adaptation planning is the process of considering climate change adaptation in development plans such as city's master plans so that are up-to-date to current national, regional and international agenda including sustainability, inclusivity, resilience and safety (Picciotto, 2002; Reda & Tripathi, 2011; Scheltema, 2017). Mainstreaming climate change adaptation planning into urban development planning has multiple benefits including avoidance of policy conflicts, reduces risks and vulnerability and enhance financial flows in sectoral plans affected by climate change impacts (Friend et al., 2013; Gupta et al., 2018; Wijaya, 2020). Mainstreaming climate change has challenges such as it may take long time ranging from years to multi-years and engages multi-stakeholders because climate change affects multiple disciplines including water, energy, human settlements, urban agriculture, infrastructures, transport, forestry and disasters (UNEP, 2011).

### 3.7.1 Arusha City Master Plan in Tanzania

Arusha City Master Plan objectives involve review of the 1986 and assess critically its implementation based on the development and growth of Arusha city; identification and assessment of the existing plans and projects that have been guiding development and growth of the city and its catchment areas; development of strategies on the best ways of implementing plans and projects in the city; study and prepare a more sustainable plan with the associated development policies that will foster realization of the city objective vision; study the situation and standards of the existing physical infrastructure services (water supply and distribution, sewerage, drainage and energy supply); formulation of city development concept policies, planning proposals *inter alia* major land uses infrastructure services for planning period; study and harmonize the existing land related acts, laws and policies and possible conception of special legal guidance of new Arusha city; and assess the existing institutional arrangement and frameworks and recommend on a workable framework for implementation of New Arusha City Master Plan (URT, 2015b, p. 4).

This paper observed that Arusha city master plan has not mainstreamed climate change in its planning process. The process of mainstreaming climate change adaptation into development policies, plans and programmes involves identifying the entry points at policy levels, national and local levels, sector levels and implementation levels; identification of current and future climate change impacts; vulnerability assessment; identify and analyse adaptation options; identify and costs programmes and actions for climate change interventions; implementation of adaptation interventions; monitoring and review (Gupta, 2018; Guzman, 2016; UN-Habitat, 2014;UNDP-UNEP, 2011). Due to invisibility of the mainstreaming process in the master plan, it is difficulty to underscore at which stage the process of mainstreaming climate change adaptation in Arusha city master plan has been reached. Moreover, despite the involvement of various stakeholders in preparation of the master plan including those deals with environment and climate change yet mainstreaming climate adaptation process is not visible in the master planning process. However, the scope of the Arusha city master plan provides *inter alia* detailed land use planning in which zoning regulations are residential, commercial, industrial, parks and open spaces, special zones and overlay with land uses such as transportation, public utilities, prison, defense area, cemetery, airport and agriculture as seen in Figure 8.2 (URT, 2015b, p. 7). Land use planning by nature is

climate smart planning practices because is advocated as a key strategy for adaptation to climate change in urban areas (Satterthwaite & International Institute for Environment and Development., 2007; UN-Habitat, 2014).

### 3.7.2 Dodoma National Capital City Master Plan 2019 - 2039 in Tanzania

Dodoma National Capital City master plan was developed with a vision of being an economic hub, academic city, tourist destination, inclusive city, recreational city, eco-friendly and green city, smart city, multi-centrality and transit centered development (URT, 2019). This vision is aligned to national, regional and international climate policies including Tanzania Nationally Determined Contribution and its National Climate Change Response Strategy (2021), Agenda 2063 on the Future Africa We Want, the New Urban Agenda (2016), the UN 2030 Sustainable Development Goals 17 goal 11&13 on sustainable cities and communities and strengthening climate actions respectively, the Paris Agreement (2015) and the Sendai Framework on Disaster Risk Reduction (2015) (SWECO, 2020; UN-Habitat, 2016, 2020; United Nations General Assembly, 2015). These policies promote safety, resilience, inclusive and sustainable cities and communities in urban areas (UN-Habitat, 2016). This paper observed that, despite the vision of Dodoma National Capital City Master Plan to address these national, regional and international climate policies yet the city's master plan does not indicate clear the stage at which mainstreaming climate change adaptation planning has been reached. Mainstreaming climate change adaptation planning involves identifying the entry points such as policy levels, national levels, local levels, sector levels and implementation levels; climate change impacts and vulnerability assessment; identifying and analyzing adaptation options; identify and costs programmes and actions for climate change interventions; design and implement a plan for mainstreaming climate change adaptation planning; monitor and evaluate the climate change adaptation (UN, 2015;UN-Habitat, 2014;UNDP-UNEP,2011). Moreover, Dodoma National Capital City Master Plan does not show climate actions which have been implemented in the city provided that the city considers modern urban planning theories such as smart city, slow city and ecological city (eco city) that focus on social, economic and environmental sustainability with the target of reducing cities vulnerability to climate change and its impacts (Rysz & Mazurek, 2015). Araos on the study of climate change adaptation planning in large cities observed that from 401 local governments globally in urban areas with above one million people only 61 cities (15 percent) reported any adaptation initiatives and 73 cities (18 percent) report on planning towards adaptation policy (Araos et al.,2016). The main reasons for inadequate climate change initiatives reporting by local governments includes inadequate adaptive capacity in terms of institutions, finance and knowledge on climate change (SWECO et al., 2020; Lawrence, 2015; Kiunsi, 2013).

### 3.7.3 Mbeya City Master Plan in Tanzania

The main objective of Mbeya master plan is to guide and manage city's urban growth in a sustainable manner for a horizon period of twenty years 2019 – 2039 and beyond 2050 by setting priority areas redevelopment, upgrading of informal settlements as well as land adjustment schemes (URT, 2020, p. 2). The specific objectives of Mbeya city master plan consist of reviewing the previous master plans 1984 – 2004 and 2003 – 2013, assess the implementation levels and propose proper physical development in the city including provision of suitable transportation systems, adequate public utilities and services, adequate commercial, industrial and recreational areas (parks, open spaces), designating adequate land for urban agriculture and conservation/buffer zones and reserving land for future development (ibid).

This paper observed that Mbeya city master plan has mainstreamed inadequately climate change in its planning process. This is indicated by the terms of reference (ToR) developed by Mbeya City

Council for the Consultancy Firm to show that, among of the objective included identification of climate change impacts and natural disaster risks and zones and propose corresponding strategies/measures to address these challenges through the plans was not addre (URT, 2020, p. 186). Moreover, Mbeya city master plan development concept provides that, in order to achieve that objective, it will ensure that urban planning and designing criteria emphasis on green growth, compact city, smart city, transit-oriented development, multi-use development, sustainable urban regeneration and improved informal settlements (URT, 2020, pp. 3, 48). Furthermore, the city master plan on component I for preparing the master plan it proposes for the city that copes with climate change including global warming, environmental friendly city with low carbon creation and energy serving, up-bringing of green industries and support for creating adequate open spaces and eco-transportation system (ibid). Despite these provisions by the ToR in Mbeya city master plan, climate change impacts and natural disaster risks and corresponding strategies/measures were not described in the master plan. Similarly, component I of the master plan provides for preparing a New Master plan that guides future city development by promoting more compact, socially inclusive, better connected and integrated city within itself and its surrounding areas that foster for sustainable development and is resilience to climate change (URT, 2020, p. 2). This is due to lack of priority of climate change in urban development planning framework and inadequate technical capacity to mainstream climate change in urban development policies, plans and programmes. However, the proposed master plan for Mbeya city provides land uses for forest and reserve, open spaces and green belt which foster for inclusive, resilient and sustainable Mbeya city. This imply that Mbeya City Master Plan is aligned with ongoing global development agenda including the new urban agenda 2016, Agenda 2063 on the Africa We Want (2015), UN 2030 sustainable development goals (goal 11 on sustainable cities and communities and 13 on climate actions), the Sendai Framework on Disaster Risk Reduction 2015 - 2030 promotes inclusivity, resilient and sustainable cities (AU, 2015a; Kernaghan & da Silva, 2013; UN-Habitat, 2014, 2016, 2018; UNEP, 2011a). (URT, 2020, p. 75). Besides, it shows that climate change adaptation measures for inclusive, resilient and sustainable cities are mainstreamed in the proposed land use plan for Mbeya City Master Plan but are not articulated adequately in the main text due to lack of attention by urban planning practitioners in climate change. On the other hands, the stakeholders involve in planning process didn't engage relevant institutions dealing with climate change coordination in the planning process (URT, 2020, p. 182).

### 3.7.4 Mwanza City Master Plan in Tanzania

The objectives of Mwanza city master plan are to review previous master plans of (1975-1982; 1992 – 2012; 2008 – 2028) and assess the relevance of the ongoing proposed projects; prepare a sustainable plan by closely aligning it with vision, goals and objectives of the city and district councils; study existing conditions of the infrastructure services and utilities; formulate the city development strategies and planning proposals for the horizon year 2035; study and incorporate existing land related acts, laws and policies in the master planning processes; and study the existing institutional setup and recommend implementation strategy for the master plan (URT, 2015c, p. iii). The rationale for reviewing the previous master plans was due to the fact that they were not effective to guide the city's growth which resulted into various challenges including socioeconomic, environment and physical conditions which exacerbated the urban and rural areas not livable (URT, 2015c, p. xiii).

This paper found that Mwanza city master plan has not mainstreamed climate change in its planning process. There is neither visibility of the process of mainstreaming climate change adaptation planning into the city master plan nor information on the implementation of climate action measures in the master plan. This is indicated by the objectives of the city master plan which lack component of climate change (URT, 2015b, p. xiii). Similarly, the stakeholders involved in the planning process misses relevant institutions dealing with climate change coordination (URT, 2015b, p. i). This imply that Mwanza city master plan 2015 – 2035 is not aligned with ongoing global climate development agenda

including the new urban agenda 2016, Agenda 2063 on the Africa We Want (2015), UN 2030 sustainable development goals 17 (goal 11 on sustainable cities and communities and 13 on climate actions), the Sendai Framework on Disaster Risk Reduction (2015) promotes inclusivity, resilient and sustainable cities (AU, 2015a; Kernaghan & da Silva, 2013; UN-Habitat, 2014, 2016, 2018; UNEP, 2011a).

## *Conclusion and Recommendations*

This paper concludes that mainstreaming climate change adaptation planning in urban development policies, plans, programmes and strategies has inadequately undertaken by planning authorities in developing countries. This is indicated by inadequate consideration of climate information including climate change impacts and vulnerability assessment and implementation of climate change adaptation measures in cities master plans of Arusha, Dodoma, Mwanza and Mbeya. Arusha city master plan has not mainstreamed climate change in its planning process because of invisibility of the mainstreaming process in the master plan and hence difficulty to underscore at which stage the process of mainstreaming climate change adaptation in Arusha city master plan has been reached. Dodoma national capital city master plan despite its vision to address such as national, regional and international climate policies including the new urban agenda (2016), UN 230 sustainable development goals (goal 11 that promotes sustainable cities and communities) (2015) yet the city's master plan does not indicate clear the stage at which mainstreaming climate change adaptation planning has been reached. Mbeya city master plan has not described climate change impacts and natural disasters and corresponding strategies/measures despite the terms of reference (ToR) developed by Mbeya City Council for the Consultancy Firm. Mwanza city master plan has not mainstreamed climate change in its planning process because of neither visibility of the process of mainstreaming climate change adaptation planning into the city master plan nor consideration of climate information including climate change impacts and vulnerability assessment and implementation of climate change adaptation measures. This is indicated by the objectives of the city master plan which lack component of climate change. The inadequate mainstreaming of climate change adaptation planning in urban development policies, plans, programmes and strategies is caused by inadequate adaptive capacity in terms of institutions, finance and knowledge on climate change, lack of priority actions for climate change adaptation planning in urban development policies, plans, programmes and strategies.

The paper recommends that, in order to mainstream adequately climate change adaptation planning in cities master plans in low and middle income developing countries there is a need to promote adaptation planning and management capacity in terms of institutions, finance, infrastructures and knowledge on climate change, prioritise actions for climate change adaptation planning in urban development policies, plans, programmes and strategies for cities resilience to climate change.

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