

How Public Private Partnerships Support Climate Mitigation and Adaptation Agenda in Cities

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Abstract-Climate change has become a major supply chain issue among cities. As a supply chain, it is recognized that achieving strides requires a network of partners and effort. Recent catastrophic events like floods among some of the world's top cities in Belgium, China and Germany [52] have contributed to growing need for cities to mainstream climate resilient actions in their supply chains. The idea of adopting a supply philosophy is echoed by that assert that supply chains is underpinned by strategic relationships that form to improve organizational socio- economic objectives through enhancing capabilities with synergies that reside in partnerships.

In addition, recent effort by COP 26 has buoyed the emphasis for improving neighborliness of climate and humankind. Since cities anchor national prosperity and act as and centre for policy making and actions for the country, they act as an important administrative structure for championing climate agenda. Although the literature on adaptation to climate change is rapidly expanding, little is known about how the adoption of new public management tool, public private partnerships (PPPs) contribute to climate sustainability, yet the adoption of PPPs is on the rise in traditional and emerging smart cities. Based on a review of literature, this study provides insights on how PPPs can enable city

administrations to play a key role for supporting climate sustainable agenda of nations especially in Sub Saharan Africa that is considered a victim of climate change and yet this part of the world is deemed to have been insignificantly responsible for the climate change by largely affected negative effects of today's climate change.

Keywords- public private partnerships, cities, climate change, COP26

1. Introduction

Climate disruptions are a shock to most cities across the world. Cities tend to be more affected since they reside with significant size of a nations population. To deliver services for her dwellers and visitors, cities must design service delivery paths to exploit opportunities and challenges they encounter. The service delivery paths are characterized by flow of resources, actors, networks, characters of a supply chain.

In the wake of the floods, city administrators are struggling, find solutions needed to manage climate sustainably [52]. Commentators ascribe the problem to the Global climatic change, a phenomenon comprised of such contributing factors as a surge in changes in climate and the reevaluation of strategies that cities are making

to mitigate and adapt their actions with the current climate change effects.

While climate change has been debated at local level, there exists global concern over the trend climate is taking. From the Kyoto Protocol Paris Agreement and now United nations COP26, signifies the importance of climate change and the rush to manage its effects. COP26 is a Climate Change Conference that rigs together world leaders to discuss and develop together unified strategy for managing the global climate change [43]. The aim of the conference is to gain consensus on progress and commitments towards reducing global climate change [42]. Recently recognizing the impact of the climate change, global leaders recently agreed to reduce global temperatures by 1.5% at the 2021 COP 26 conference held in the Glasgow in the United Kingdom [42].

While climate change is a global concern it is opined that it requires not only global but local action [29]. But what is climate change? While the term “climate change “is popular, it becomes bothering to understand. Therefore, attempts to define climate change have been made in text but impact definitions have been made through the power of anthroposcenic drawings [36]. Accordingly, it is argued that Anthroposcenic definitions tend to draw attention to the ways in which science informs artistic interventions and shapes policy initiatives. For example, a picture of reducing coastal line of a lake would provide better meaning of a reduction of water due to global warming and water losses resulting either from reduced rainfalls or causing a need to account for the reduced water and increased coast line. Commonly used by geologist as a means of defining phenomena and how it evolves [37& 38].

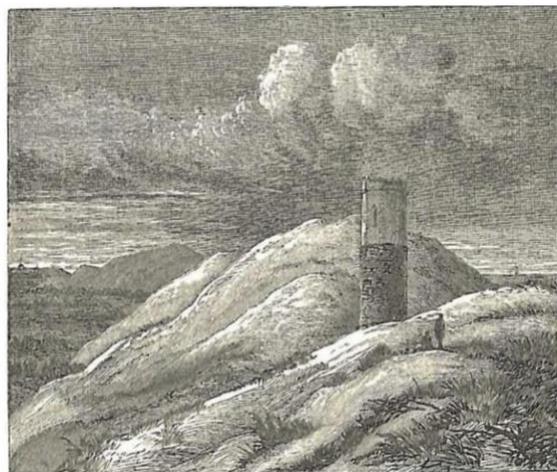


Figure 1: Tower of the buried Church of Eccles, Norfolk, A.D 1839.

Source: [36;5]

In figure 1, the inland slope of the hills of blown sand is shown in this view, with Lighthouse of hasboroush, N.W. of the tower, in a distance. In figure 2 below

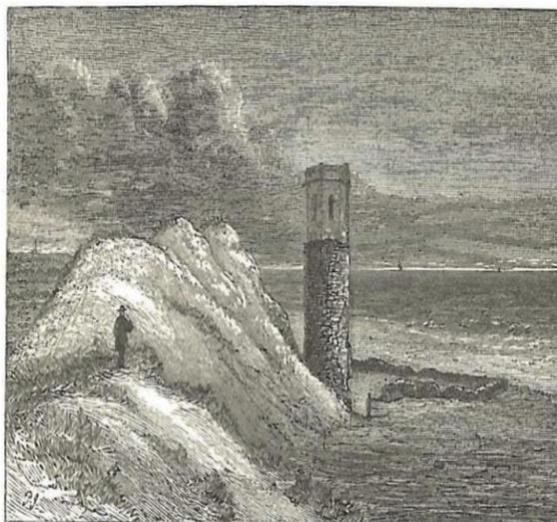


Figure 2; Eccles Tower after the storm of November 1862

Source: [36;5]

From Figures 1 and 2, it can be observed that climate change is about the effects to infrastructure, the earth and its surroundings due to abnormalities such as storms, tornados, unseen winters with now in areas that have never witnessed snow falls or extended summer of

periods of droughts that have interrupted human life and livelihoods. Attempts to define climate change exist. According to government of New Zealand and as cited by [39] and [40] define climate change as the “heating up the atmosphere, raising sea levels, increasing ocean acidification, increasing the frequency and intensity of storms and other extreme weather events that will make life seriously endangered”. Several factors have been associated with climate change.

While this exist, we restrict our study to the major cause of climate change in cities, as centres buoying with the largest economic activity in the world

Climate change been associated with municipal solid waste management [26] & [29]. Annually, it is estimated that the world produces 1.3 billion tons of waste. This is likely to increase with a prediction that the waste production shall be reaching 2.2 billion tons of waste per year by 2025 [26]. While the rural parts of nations produce waste, it is opined that much of the waste is produced in municipalities and cities [27] & [29].

Recognizing the effects of the changing climate patterns, climate mitigation and adaptation strategies have been designed and implemented. Climate mitigation has been defined as the act of preserving the climate [50]. Realizing that balancing livelihood with mitigation is almost impossible, government and climate actors, climate adaptation refers to attempts that seek “to minimize the impacts of climate change, the development of climate change policies and strategies that take into consideration the local realities “[51;340]. In most cases while climate mitigation efforts were aggressively championed, major focus is skewed towards balancing climate mitigation with adaptation especially in localities considered to resonate with higher climate impacts. While it is now recognized that climate change has no boundaries, it can be recognized that while the effects have no boundaries, the boundaries of climate destruction. For instance, at the recently concluded COP26. At the conference it was confirmed that China and India are the world’s leading polluters yet the impact

of climate change is faced by those that are largely deemed irresponsible for the change like developing countries in Africa and Asia. In this context cities are now recognized like China and India as part of the world’s largest polluters [26 & 42].

Studies by [26] do confirm that there exists a significant relationship between cities and climate change. While the relationships have been deemed to be largely positive, the adoption of public private partnerships has been promoted to neutralize the relationships between cities and climate change. This view point is underscored by [53] that asserts that collaboration of supply in a supply chain may serve as a mediator between the creation of value in an organisation and its practical orientation [53]

Commencing with a slow pace in the developed world particularly among Dutch economies [29], the alliance of cities, climate and public private partnerships is on the rise. This has been partly due to growing challenges and problems that face policy makers and implementers [19]. Historically, cities in Europe met regularly to discuss climate change and strategies to mitigation and adaptation [18]. In national and international and global events, the triage can no longer be discussed independently as they have formed an ecosystem that defines national and global paths. Cities have been viewed as centre of prosperity across the world, contributing to over 50% of national Gross Domestic Product [18]. At the same time, cities have been not only drivers but also hit hard with the effects of climate change. Therefore, cities possess sites with a great potential to address matters of climate change [8], [17]. The reasons that have been associated with the city as a force for have largely been the city industrialization character and high population densities. The pressure to industrialize has been due to the need to locate in the city, where buying power dominates in countries. Studies by indicate that countries middle class tend to reside in cities. This then could help to define why industries locate in cities and not in peri-urban and rural areas [17]. As population density increases, more waste is generated yet budgets for waste management

have either remained static or shrunk with reduced transfers to local government where cities tend to be governed. In addition, since cities are centres of opportunity, their character has attracted both the rich and poor in cities at a pace and volume beyond what city administrations have planned for. This has resulted into pressure on roads, waste management facilities, housing resulting into war on the roads as pedestrians, motorists compete to use the limited transport infrastructure, filthy cities as a result on constrained waste management facilities, slum development and blockage of drainage channels among cities. Such trends have resulted into reduced precipitation and rains making cities warmer than ever before, flooding to blockage of channels with unmanaged waste causing flooding and filthiness that resulted with unmanaged waste and flooding in cities. The nexus of events in cities, has attracted the adoption of public private partnerships (PPPs). Traceably from the United Kingdom under Margaret Thatcher's reformist government in the 1980s, the adoption of PPPs was viewed as part of new public management (NPM) [44,45,46 &47]. Under the tenets of NPM was to reform government so that it can deliver service to citizens in a much more efficient and effective way [48 & 49]. To cause the reform, Thatcher's government sought to adopt private sector principles into public service delivery [48]. This resulted into the adoption of PPPs that have now become a popular yet critiqued mechanism in service delivery across the world. PPPs have been largely known for their role in improving service delivering and adopted as a procurement method, project financing mechanism, and as a project delivery method.

2. Literature Review

A review of literature indicates that a growing number of scholars [1], [2] and organisations such as the United Nations in its Sustainable Development Goals No.17 (Partnerships for Goals) observe that attempt address the multiple challenges of global change cannot be addressed by state as a sole actor but rather by an ecosystem of both state and non-state actors [6], [7] & [8]. This has laid foundation for the

acceptance of public private partnerships as a form of networked governance across the transport, agriculture, telecommunications education, healthcare, energy sectors across the world and now climate [1]. As a network, PPPs are defined as a practice where a government entity contracts a private sector actor (s) to design finance, build, operate and maintain infrastructure to produce and deliver a service to citizens. In such arrangement the private actor is incentivized through the receipt of user fees paid by the citizens that consume their services such as electricity, water, waste management services etc. The second option for incentivizing the private actor is usually through availability payments. In other studies, [1:280] defines "Public-private partnerships—that is, networks of different societal actors, including governments, inter-national organizations, corporations, research institutions, and civil society organizations—have become a cornerstone of the current global environmental order, both in discursive and material terms". The definition tends to enhance existing traditional and recent definitions that have restricted the partnership to only the private and public sector actors (s) [9], [10], [11], [12], [13], [14], [15]. Therefore, from the review of definitions this paper seeks to position its climatic governance perspective by defining PPPs as partnerships that posit as ecosystem of public, private and or third sector actors coming together through a concession agreement to co-produce and deliver a public service in a manner that mitigates and is adaptive to the global climate change.

During the last three decades, scholars in the discipline and specializations namely; procurement, engineering, project management and public management have made tremendous effort on elaboration of PPPs. The existing body of knowledge on PPPs has focused largely on critical success factors, application of PPPs across sectors, PPPs in local government, models of PPPs, PPPs as a model for networked governance. However, little research is known on a PPPs and their broader implications on climate governance. As the world seeks for solutions to reverse the global climatic change,

research on PPPs has remained largely silent on PPPs and their role in supporting climatic governance. Attempts to assess PPPs contributing to climate governance have started but it is opined that reliable data on climate change partnerships are hard to find and biased toward the most visible partnerships [1]. In other cases, PPPs have been largely critiqued for being implemented with opaque Environmental Social Impact Assessments (ESIAs) with those implemented in the energy sector facing severe critique for not destruction of the environment at the expense of generating electricity [3], [4], [5]. Despite this critique PPPs elsewhere have delivered both infrastructure and services with positive accolades [30]. While the PPPs have delivered impact on climate change matters [30], this attribute tended to remain silent yet by recognizing such positive attributes we can escalate the role of PPPs in delivering green urban infrastructure for both climate mitigation and adaptation

This paper therefore seeks to explore PPPs that have been implemented in the climate governance and their role in climate governance based on lens. To achieve this purpose this investigation shall be guided by the following questions, namely;

RQ 1: What sectors can PPPs be deployed to support climate governance?

RQ 2: How have PPPs supported climate governance?

3. Methods and Materials

The investigation adopted a systematic literature review of PPPs and their role in climate governance. We adopt a case study approach to assess sectors in which PPPs could have higher potential to support climate governance potential in terms of mitigation and adaptation while retrieving best practices that be implemented by existing and emerging cities to support the global agenda of COP26 of reducing world emissions to 1.5CO₂ emission by 2030. In the case studies we adopt an integrative approach. According to [19] an integrative approach that involves pooling, integrate and compare data in order to gain meaningful insights to inform the

application of PPPs in climate governance agenda.

Data Collection: Search Strategy

To perform the review, we used scholarly online database search engines such as Scopus, JSTOR, Emerald and Google Scholar with key words namely; public private partnerships and climate governance. In addition, we used our expert intuition to review existing well documented case study from a compendium compiled by the World Bank for India. The choice of selection is because the paper seeks to address climate governance of cities using PPPs from a developing country context [20], [21] & [22]. While India and China were recently reaffirmed to be the world's largest polluters [23], [24], India is chosen since it has some reliable data documented by the reputable Institution (The World Bank) on the progress made in implementing PPPs that have not been linked to service delivery despite the lesson they provide for implementing PPPs in well aligned sectors and best practices for ensuring their success at all stages of the PPP cycle. Based on the online searches, we reviewed title, abstracts, conclusions and implications in trace of the relevance with the investigation on PPPs and climate governance. Those papers selected were later read in full alongside the compendium of PPPs in India. From the readings, our analysis was formed.

3.1 Data Analysis

While themes tend to emerge from the readings like it happens in empirical studies, we chose to maintain the themes areas from from our research headed but captured the information sourced from the analysis as narratives that formed the results and discussion in the investigation.

3.2 Ethical considerations

In undertaking systematic studies, exposure to ethical vulnerability may occurs. We adopted [25] code of practice. According to [25] ethical issues should be into grouped into eight thematic areas: 1) responsibility, 2) transparency and consent, 3) privacy, 4) validity, 5) access, 6)

enabling positive interventions, 7) minimizing adverse impacts, and 8) stewardship of data. While the 6 criteria have been adopted in other studies that have adopted systematic review approaches [25]. We cite sources of data used, by non-disclosure of names of individuals in the study. To ensure validity we only include data from peer reviewed journals and used reports and compendiums from globally reputable institutions like the World Bank.

3.3 Limitations

The search was limited to developing countries anchoring on India and the greater BRICS and others the developed world such as Europe. While the investigation seeks to provide lessons for use of PPPs in climate governance in Cities, not much studies have been undertaken to showcase workable PPPs in the area of climate governance in Sub Saharan Africa. The literature reviewed is limited to peer reviewed article in English and may have missed out publications in non-English authored language that would benefit this paper especially in countries like China and Brazil where publication of knowledge on critical global issues in non-English language is popular. We also acknowledge that as we research and write and at the time of publication, new knowledge may have been published and would benefit this study but may miss being captured. While some data in case studies especially from the compendium of PPPs in India is old by year of publication. None the less the paper is not about what is current but seeks to provide policy makers and practice by making a contribution on the applicable sectors and how PPPs can be adopted as part of the ecosystem necessary to support climate governance agenda in cities. The notable key success factors for climate resilient PPPs

4. Results

Public Private partnerships in climatic governance: assessing their sectors of application, performance and broader implications

Features	Case studies of PPPs and Climate Governance		
# case studies	Case Study 1 Alandur Sewerage Project	Case Study 2 Karnataka Urban Water Supply Improvement Project	Case study 3 Timarpur Okhla Integrated Municipal Solid Waste Management Project
City and contracting authority	Alandur Municipality and the Tamil Nadu Urban Infrastructure Financial Services Limited (TNUIFSL) -India	Karnataka Urban Infrastructure Development and Finance Corporation (KUIDFC)	New Delhi Municipal Corporation (NDMC) and Municipal Corporation of Delhi (MCD)
State and year PPP signed		Karnataka 2005	Delhi 2008
Sector	Sewerage	Water & Sewerage	Urban Infrastructure - Municipal Solid Waste
Promoter/SPV	VRCL Infrastructures and Projects Ltd and Va Tech Wabag Technologies Ltd.	Jamshedpur Utilities and Services Company Limited and Voltas Limited	Jindal Urban Infrastructure Limited
Project Description	A sewerage system was to be designed for the estimated population of about 300,000 in 2027 and was planned to be completed within a five-year period from its inception date. The project components included: A sewerage network consisting of the main sewer line, branch sewer line and manholes; Construction of a sewage pumping station; A sewage treatment plant; and Low cost sanitation In the initial phase the plant was to treat 12 million litres per day (mld) of sewage supplied to it by the municipality. The ultimate capacity was to be 24 mld.	The rehabilitation/construction activity largely included replacement of the distribution pipelines, installation of bulk water meters and consumer meters and setting up of a computerized 27 billing system. The rehabilitation activity, to be undertaken by the private developer, was to be funded from KUIDFC funds as a grant to the project. A maximum of ` 42 crores was set aside as the grant amount for the capital works, and the private developer was required to carry out the rehabilitation works within this sum	Delhi generates 7,000 metric tonnes (MT) of Municipal Solid Waste (MSW) daily, which is expected to increase to 18,000 MT by 2021. The present landfill sites that are being utilized for disposing the garbage are approaching their full capacity and even with the envisaged capacity addition, the situation is unlikely to improve. The Municipal Corporation of Delhi (MCD) has thus embarked on a project to reduce the amount of MSW being disposed in the landfill sites and utilizing the waste for productive purposes such as generation of power from waste. MCD has identified two locations, namely Timarpur and Okhla, for implementing this project. The Municipal Corporation of Delhi (MCD) has thus embarked on a project to reduce the amount of MSW being disposed in the landfill sites and utilizing the waste for productive purposes such as generation of power from waste. MCD has identified two locations, namely Timarpur and Okhla, for implementing this project. The following facilities are to be developed as a part

			of the integrated municipal waste handling project: i. Plants for converting MSW to Refuse Derived Fuel (RDF), capable of processing 1300 TPD at Okhla and 650 TPD at Timarpur. ii. A bio-methanation plant capable of handling of 100 TPD of green waste at Okhla. iii. A water recovery plant capable of handling up to 6 MLD of treated sewage at the Okhla site for recycling into process water and cooling water. iv. A Power plant with a generation capacity of 16 MW at Okhla. 5. Transportation of RDF from Timarpur to Okhla for combustion in the boiler of the power plant mentioned above. The project is registered with the United Nations Framework Convention on Climate Change (UNFCCC) for the Clean Development Mechanism (CDM) to earn 2.6 million Certified Emission Reductions (CERs) over a ten-year period.
Concession type	Construction Contract (Underground Sewerage System) O&M Contract (Underground Sewerage System) Build-Operate Transfer (BOT) Annuity (Sewage Treatment Plant)	Operations & Management Contract	BOOT (includes Design and Finance)
Concession Period	O&M Contract – 5 years BOT Annuity – 14 years	42 months (Later extended to 59 months)	25 years
Incentive Framework	<ul style="list-style-type: none"> 12 crores out of the capital cost was through public contribution Collection of sewerage fee from the public (on a graded structure amounting to a weighted average of ` 75 per connection) amounts to ` 2 crores per month and covers both debt repayment and O&M costs of the AM 	Not provided	Not provided
Justification	Prior to 1996, the town did not have an	Frequency of water supply ranged between once in 7	The project is expected to reduce carbon

for PPP	underground sewerage system and all sewage was managed with individual septic tanks. The largely unregulated disposal of sewage in storm water drains was an environmental and health concern for the local residents and was frequently raised as a political issue. Around 98% of 19,800 households used either septic tanks or holding tanks collected periodically by tankers and disposed in the low-lying areas outside the municipal limits.		days for Hubli-Dharwad, once in 2 days for Gulbarga and on alternate days in Belgaum. Also, it was assessed that the Non-Revenue- Water levels in these cities was on an average higher than 50%		emissions substantially. Total estimated reductions in carbon emissions are expected to be 2.66 million tonnes of CO ₂ e over 10 years of operations.	
Contribution to Climate Governance	Before PPP Intervention	After PPP intervention	Before PPP Intervention	After PPP intervention	Before PPP Intervention	After PPP intervention
	<ul style="list-style-type: none"> • No sewerage system for a population of 165,000 • Water borne sanitation facilities, septic/ holding tanks for disposal of night soil • Unregulated disposal of sewerage in storm water drainage and low lying areas • Open storm water drains stagnating in outer areas of town – environmental and health hazard • Contamination 	<ul style="list-style-type: none"> • 120 km of underground sewerage system, pumping stations and an STP of 24 MLD • Underground sewerage system with direct connection to each household • Modern sewerage treatment plant designed to international standards. • Underground sewerage system has eliminated risk of mosquitoes and related diseases for the citizens of Alandur and surrounding areas • Almost 100% 	<ul style="list-style-type: none"> • Hours of supply- (Average of 3 hours in 3-7 days) • Average pressure in the distribution system (m) (0-5 m; highly un-equitable distribution) • Population served (180,000) • Number of public fountains (433) • Losses as a % of input (More than 50%) • Metering(Negligible) • Computerized records maintained/ bills based on monthly readings issued(Ni) 	<ul style="list-style-type: none"> • Hours of supply(24*7days) • Average pressure in the distribution system (m) (17.70m) • Population served (180,000-250,000) • Number of public fountains (Nil; all customers have been provided with individual metered connections) • Losses as a % of input (10%) • Metering (100%) • Computerized records maintained/ bills based on monthly readings issued(100%) 	Solid waste was bulging with no budget for its management	The involvement of the private sector has assured that the water supply and sewerage services would be provided to the IT and the other industrial units in sector V during the concession period. This is critical infrastructure to support the development of IT units as in line with the GoWB's vision

	of underground water sources due to open drains	eradication of ground water contamination through underground sewerage system and waste water treatment plant				
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Source: World Bank & Government of India (2010) with additional analysis by authors

Our analysis from table 1, on PPPs in India, reveals that PPPs can contribute to managing solid waste management in cities. For instance, in the case of Alandur and New Delhi PPP models implemented enabled the cities to increase capacity to manage solid waste. This is because cities have been argued to exert activities that are responsible in generating solid waste that has become an environmental hazard, making cities a major contributor to the current global climate change [26]. By deploying PPPs in solid waste management, city administration provides an alternative source of finance to manage staggering waste in cities at a time when central transfers are dwindling and or increasing at a rate lower than the rate at which waste increases in cities.

Untreated sewerage has contributed to climate change [27] & [28]. A study in Oman indicates that untreated waste water results warming. This intern results into reduced precipitation and rainfall, consequentially impacting on agricultural production. From the works of [27], it can be concluded that climate change effects affect more the developed countries, whose majority reside in Sub Saharan Africa. This is because most developing countries rely on agriculture for their livelihood. Therefore, reduced rains amidst a growing SSA continental and global population implies that the failure to develop strategies among which include PPPs to manage the climate change expose human kind to not only hunger [27], income, disease [27] and death.

In addition, studies indicate that over the last 20 to 30 years, efforts at local government where city administration largely resides has been on mitigation rather than adaptation. Therefore, as cities explore strategies to management climate change they must not only think about for sewerage

and water systems that have largely been designed as mitigation strategies. Cities must explore and design strategies for climate mitigation. Part of the PPP interventions in climate mitigation have been in green urban infrastructure and housing. Green urban infrastructure related with infrastructure deployed in green parks or spaces that reside in cities. According to [30] a call for private participation investments(PPIs) in green urban infrastructure started in 2012 by the Organization for Economic Cooperation and Development (OECD). The motive behind the call was to realize and accelerate the delivery of low carbon climate resilient infrastructure [30]. The option for delivery of infrastructure were PPP models where the private would be engaged to undertake and provide Design, Build, Finance, Maintain and/or Operate (DBFMO) functions in the concessions agreed.

The deployment of PPPs in accelerating decent accommodation has some links with climate mitigation and adaptation action. Works by [31] indicate that the development of slums in cities can result into pressure on sewerage channels, cause settlements in areas planned and infrastructure installed for water and waste flow [31]. Such distortions have results into blockage of sewer systems causing blockages and flooding. Worse still it is opined that the poor and slum settlements tend to reside in settlements that lie across low land making slum dwellers in cities more flood prone. In another study, it is revealed that slum dwellers resided 50metrers [32] at shores of water sources making them prone to floods arising due to unbalanced rains than tend to floods water sources like rivers, streams and lakes. Realizing these events governments and city administration have e deployed PPPs in housing projects as part of their spatial plans. To reduce this challenge, novel slum upgrading model have been proposed since it it propel the reversal of climate change effects on a society [31]. However, cities have not been able to finance such developments and thus resorted to PPPs. According to [33] PPPs have been deployed to provide affordable housing in Nigeria, considerably one of Africa 2 biggest economies to reduce slum development and expansion and its nuances in urban spaces. Unfortunately, while the objective was novel, the outcome of an investigations reveal that significant contribution was not made with regard housing low-income earners as housing units constructed were bought off by the high- and middle-income earners [33]. Perhaps inefficiency of sectoral deployment could be informed by studies on whether the rich invest nor get their riches [33]. Accordingly, it is revealed that the portfolios of investment by the rich have largely included real estate [34], [35] & [36]. This finding seems to imply that the design housing project delivered may have not been informed the needs of the slum dwellers such as affordability, location and aesthetics

A range of key success factors for PPPs deployment for climate resilient projects in cities have also been identified. The review indicates that while PPPs have been deployed for climate resilience projects both success and failures are reported [30]. Notably for projects that have succeeded several factors are noted, namely user/citizen involvement from the start. Citizens

must be informed of the short and long-term benefits of the PPPs if citizens are to achieve the benefits for PPP implementation for climate change in their territories of governance.

A real options analysis that combines both financial, social, economic and sustainability parameters for the selection of the best evaluated tender (MEAT) should be deployed. Bidders should also be involved in the procurement process through bid meetings to elaborate on the working criteria for selection that will result into the selection of the most economic advantageous tender.

5. Conclusion

We began this article with the observation that the global climate change has traumatized cities and their paths to deliver services to dwellers and visitors. We conceptualized delivery paths of cities as conceptualized as a supply chain. By contextualizing service delivery paths of cities as supply chains, we acknowledged that a key feature for the success of cities in managing climate change is the to establish of networks. From this principle we note that one of the increasing networks that cities adopt to deliver solutions to problems they face are public private partnerships. While PPPs have been adopting as a source of finance, and innovation, little is known on how PPPs play a role in implementing city climate mitigation and adaptation agenda. We the set out to examine patterns of PPPs adoption that had a link with climate mitigation and adaptation. From a systematic analysis of PPP studies, conclusions are derived. Public Private partnerships are a vital network for climate mitigation and adaptation. Among cities, the adoption of PPPs in sectors such as sewerage, waste management, urban green parks and housing PPPs can help to reduce global warming by taking waste to its appropriate home in cities, reduce flooding, extend water in water stressed areas or areas with limited access and reduce slum development in cities. Notably PPPs in water increased after production and delivery mechanisms while providing technologies to reduce water losses and metering while serving increase in population. In the waste management sector, PPPs have increased cleanliness, waste treatment thus reducing waste on land surface that tended to affect precipitation and flooding that resides with nuisances such as traffic jams causing

additional pollution and fossil energy use by vehicles in traffic.

PPPs have been known for providing access to private finance, innovation, technical knowledge and skills, managerial efficiency and entrepreneurial spirit, and the role of public actors, including social responsibility, social justice, public accountability.

The study adds to existing knowledge by illustrating yet another benefit of PPPs. PPPs have a potential contribution to climate mitigation and adaptation.

However, it is noted that while the uptake of PPPs is on the rise, there exists dissent for this conventional approach in service delivery. If not handled, the uptake and mainstreaming of PPPs supply chains of cities is likely to remain limited despite the value that PPPs provide in developing climate resilient supply chains.

Future studies should focus on ways for developing advocacy agenda for PPPs in order to increase public awareness and stakeholder commitment for uptake in city, national and global uptake. In additions

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