



Research article

Everyday adaptations to flooding at the micro-levels of low-income communities and macro levels of authorities in the megacity of Lagos, Nigeria

Olasimbo Fayombo*

Department of Geography, The University of Sheffield, Western Bank, S10 2TN

* **Correspondence:** Email: oofayombo1@yahoo.co.uk.

Abstract: The contextual nature of adaptation demands insights into the effects of actors' actions, decisions, and negotiations at different levels in the adaptation process to facilitate harmonizing and targeting actions. However, researchers who examine these activities at the micro level of communities and macro level of authorities in Sub-Saharan Africa are sparse. Consequently, using a qualitative approach and the Asset Adaptation Framework, we explored the everyday adaptations to flooding at the micro-levels of households/communities and the macro levels of governments before, during, and after flooding events in two low-income communities in Lagos, Nigeria. At the macro levels of governments, adaptation strategies centered on social reorganization and welfare, i.e., disaster reduction/management, in the temporal dimensions, situating adaptation in the adjustment/transitional flux. At the micro level, the strategies before flooding problematized the categorization of autonomous adaptation as unplanned. During flooding events, there was a difference in assets mobilized at the two levels, while macro-level actors mobilized financial assets for welfare, micro-level actors focused on social assets. After flooding, the positive psychology of self-consciousness in human assets aided the emergence of shadow networks that challenged the status quo and shaped each community's adaptation pathway/outcome. Furthermore, the human assets of faith/fate, place attachment, and autochthony used for building long-term resilience and entitlement claims aided a reposition of responsibility on the people's lifestyle by the authorities and supported a stance on adaptation as persistence/transitional. The stance on persistence/transitional pattern at the macro level notwithstanding, the shadow network in one of the communities utilized invited spaces of negotiation for entitlement claims that shifted the status quo and aided a transformational pattern. The highlighted

shift in adaptation underlines the need to understand adaptation activities in the different spheres to guide policies, align actions, and facilitate a harmonized and sustainable adaptation.

Keywords: adaptation; assets; flooding; Lagos; low-income communities; urban areas; micro-level; macro-level

1. Introduction

Although people are impacted differently by climate change, it is established that the more vulnerable group in urban areas of developing countries are low-income urban dwellers with limited responsibility but often excluded from adaptation decisions [1,2]. The moral and justice concerns the issue evokes, demand a simultaneous understanding of adaptations at the macro levels of adaptation authorities and at the micro-levels of people for a sustainable adaptation [3]. Moreover, a simultaneous understanding of the strategies at these different levels is needed to guide policies and actions in addressing the source of vulnerability and understanding response [4]. Furthermore, understanding adaptations at these multiple levels provides a platform to simultaneously tackle climate change and deliver poverty reduction benefits, which, for developing countries, links the critical priorities of development with adaptation [5,6]. Although the impacts of climate change on vulnerable groups and areas have received significant attention in the literature [6–8], works that simultaneously examine adaptation strategies at the levels of people and local authorities in sub-Saharan Africa are few [9]. Furthermore, works that examine the use of assets that are indicated as useful for addressing the competing priorities of poverty reduction and adaptation for developing countries are sparse. This paper addresses these gaps using the megacity of Lagos, Nigeria as context. Two low-income settlements and their associated local authorities were used to examine the everyday adaptation strategies for flooding at the micro-levels of households/communities and the macro levels of authorities. Two objectives are discussed in this paper:

I) To explore the assets protected, mobilized, and utilized in adaptation activities before, during, and after flooding events at the micro and macro levels to highlight the areas of concordance/dissonance of strategies.

II) To examine the implications of the asset strategies for adaptation patterns at different levels.

These objectives constitute aspects of broader research that examined the role of asset mobilization in the vulnerability and adaptation of low-income urban residents of Lagos, Nigeria to flooding. To address these objectives, the research was approached through a critical adaptation agenda in the resilience perspective on adaptation [10] and analyzed using the asset adaptation operational component of the Asset Adaptation Framework (AAF) [11]. In Section 2, a review of the relevant literature is given to situate the research and to explain the research approach, conceptual framework and the analytical tools utilized in addressing the research objectives. The research location and methodology are discussed in Section 3, while the presentation of the findings is discussed in Section 4. In Section 5, we provide an analysis and interpretation of the findings to the stated objectives. We conclude with a summary and deductions from the findings.

2. Literature review

In this section, we situate the research in the development adaptation nexus through a review of the relevant literature and defines the multiple concepts utilized in the research. In situating the research, the section first sets the context of the research through a discussion of the vulnerability of urban areas in the global south, including Lagos, to flooding, a severe weather problem exacerbated by climate change. Then the discussion indicates why the issue demands focus through a brief discussion of flooding impacts on urban areas of the global south and Lagos and indicates poor urban residents as the most impacted. Since the paper's focus at the micro level is poor urban residents, the impacts highlighted necessitate a discussion on the linkages between the development concept of poverty and the climate change concept of adaptation. Hence, the context for the first objective of the paper is highlighted through a discussion on the utilisation of assets to address the poverty-adaptation linkage based on the ability of assets to link adaptation at different scales and to address poverty. Furthermore, the context for the second objective of the paper is established through a discussion on the different conceptualisation of adaptation with a focus on the pathways in the resilience perspective and the critical adaptation agenda to explain how adaptation pathways are shaped by the assets utilized by actors. Having situated the research, the section discusses the analytical framework utilized to address the paper's objectives and concludes with a definition of the analytical tools.

2.1. Vulnerability to flooding events on urban areas of the global south and the Lagos context

Climate change is associated with increasing severe weather problems that significantly affect urban centres of the global south [12]. Increased storm surges, sea level rise, flooding, and heat extremes are some of the problems associated with climate change impacts on cities in the different IPCC assessment reports. Flood risk occurs from the effects of sea-level rise, storm surges, and heavy prolonged precipitation [13] that informed its categorization as flash or pluvial floods, urban, coastal, fluvial, sewer and glacial lake bursts with major differences being in their temporal and spatial dimensions [14]. Coastal flooding occurs due to sea-level rise, while continuous down-pours result in pluvial and fluvial floods. Spatially, fluvial floods occur when torrential rain flows into rivers and causes spillover flooding from river channels and banks into flood plains [15]. Fluvial floods could occur in an area without rain falling in its immediate environment, unlike the more localized pluvial floods that occur when urban drainages are overwhelmed by excess runoff from down-pour. Temporally, fluvial flooding has a longer duration and could last for days, weeks or months, while pluvial flooding has a shorter duration of no more than a day, which makes fluvial flooding of a higher magnitude, but as Chen et al. [15] explained, a synthesis of both as Lagos exhibits could have a dire impact [15]. The problem of flooding arises from factors that include anthropogenic changes like urbanisation and demographic activities, which foster land use change, and the geographical location of most cities in hazard-prone areas that exacerbates flooding problems, [8,16,17]. This is more significant for cities of the global south that are home to over a third of the global population resident inside cities [16], because the combination of a high population and precarious location indicates a higher population exposure to hazardous events like flooding, which heightens the concern for adaptation. Like many cities of the global south, Lagos is faced with the problem of severe weather such as increased storm surges, sea level rise, and flooding, that is predicted to continue. For instance, Lagos is predicted to experience an increase in extreme weather events with rainfall days of more

than 50 mm and a two-week longer rainy season with an annual rainfall increase of 15 cm by 2046–2065 [18].

Lagos displays anthropogenic and location factors that further exacerbate the effect of climate change impacts. For instance, due to urbanisation and population pressure, the city recorded a loss of swamp cover from 59.24 km² in 1986 to 39.1 km² in 2002, with a negative consequence of loss of coastal wetland protection [19]. Lagos State's vulnerability to flooding is further compounded by its geographical location. Located along the coast of Guinea by the Atlantic Ocean, the city-state of Lagos consists of creeks, rivers, and lagoons and has 40% of its land covered with water and wetlands [20]. These physical characteristics informed the naming of the city by the Portuguese and further informed the city's slogan as the "land of aquatic splendor" [20]. Along with the presence of these water bodies, the flat terrain of Lagos with an average height of 0.8 m above sea level makes it susceptible to inland water inundation and ocean surges [21]. As Satterthwaite et al [8] argue, the susceptibility of cities like Lagos to severe weather problems is further heightened by population pressure because of the inherent economic opportunities. They argue further that efforts to reduce the increasing population are limited by the economic opportunities offered by these cities. For instance, despite the size of Lagos as the smallest state in Nigeria, it is the economic hub of the country, housing over 70% of Nigeria's industrial and economic activities and contributing about 35.6% to its gross domestic product [22,23]. Lagos is home to about 18–24 million residents, 80% of which are resident in the metropolitan area [21,24], with a metropolitan population density of 20,000 people/km² [18]. The combination of these factors facilitates a synthesis of both pluvial and fluvial flooding experienced in most parts of Lagos [21], while communities along the coast experience the additional impact of coastal flooding from sea level rise [21,25]. The exhibited factors highlight the vulnerability of Lagos and make it a viable context for the research.

2.2. Impacts of flooding events on urban areas of the global south

Although richer countries are not immune to flooding, flooding events are established as particularly problematic for urban residents in developing countries [26,27] because the impacts of climate change are exacerbated by the level of development [5,6,28]. The lack of basic infrastructure in low-income urban areas of the global south predisposes the residents to flooding impacts. Key issues that make flooding events problematic for urban residents in the global south are its direct risk of mortality, salt intrusion, economic losses and its indirect risk of increased health, social and economic problems [13]. Across developing countries, increasing morbidity and mortality from flooding in urban areas is documented for different areas. In Dhaka, Alam and Rabbani reported that the 1998 flooding event resulted in the death of 284 persons and hospitalisation of 190,000 persons [29]. In Mumbai, the 2005 flooding led to 1,000 deaths, 30,000 deaths occurred from a 1999 flash flood in Caracas, while 300 people died and 20,000 people were rendered homeless in the 1998 Rio floods [17]. In sub-Saharan Africa, the 2002 floods across East Africa left 46 people dead in two weeks in Kenya and destroyed a minimum of 1,557 homes in Rwanda [27]. Furthermore, the 2006 flooding in Mombasa affected 60,000 people and resulted in a cholera alert in the city [30]. For Maputo, in 2013, Castán Broto et al. reported that flooding from sea-level rise over the years resulted in salt intrusion, contamination of wells and coastal aquifers, increased vector-borne diseases and damage to infrastructure that contributed to urban poverty [31].

In Nigeria, floods experienced in Port Harcourt City in 2006 displaced about 10,000 residents [32]. Flooding across Nigeria in 2012 resulted in 383 deaths, an approximate US\$160 billion loss, and a displacement of over 2.5 million people across the country [33]. These general statistics could obscure differences at state levels. In Lagos, flooding causes damage to properties and loss of lives [27,34,35]. For instance, in 2011, the city incurred a loss of US\$ 320 million and 100 deaths due to flooding [34]. The future prediction of the combined impact of extreme water levels on the economic value of Lagos state assets was estimated to be in the range of \$20.85 to \$36.34 billion by 2100 [25]. Nigeria was reported to be greatly affected by climate change due to the pervasive nature of poverty and a lack of financial and institutional capacity to address the risk of climate change impacts [18]. To support the position that the higher cost of climate change in urban areas in low/middle-income countries arises from a limited coping capacity aided by existing inequalities between and within countries [8]. However, the disproportionate impact of problems like flooding falls on poorer populations within cities of the global south because of exclusion or limited access to public services [11,36]. This has resulted in calls for a focus on poor people who dwell in more marginal locations [37–40] because the pervasiveness of poverty and inequality increases vulnerability to extreme events and influences adaptive capacities [41]. Situating adaptation discourses at the local level is further heightened by an increasing urban population and climate change impacts, which underscores the argument that what happens or fails to happen in urban areas could be of critical significance to lives and livelihoods [8], and for actions on global climate change [42].

Focusing on poorer people demands situating adaptation discourses at the local level because placing adaptation discourses beyond this level creates a disjoint that undermines the implementation of adaptation [3,39]. Furthermore, the exclusion of the primary adaptation actors at the local level facilitates missed opportunities for adaptation [6,43]. Hence, positioning adaptation discourses at the local level enables an understanding of the perspectives of the people most impacted [3], which creates the right kind of space for adaptation [37] by giving agency to the victims and revealing previously ignored opportunities for adaptation [43,44]. Furthermore, the argument that adaptation by vulnerable individuals and groups will be autonomous and dependent on their resources and social capital [6,45], shifted the focus from the macro levels of states to the micro level of people in climate change discourses, a focus described “as the most appropriate approach in trying to understand adaptation processes” [46]. This shift in focus aided the recognition of existing adaptive capacities of people and constraints to people’s capacity to adapt. These capacities and constraints are dependent on the resources or assets and entitlements that people can access when faced with stressors like flooding [44,47] to address vulnerability and build resilience to the impacts of climate change. Assets ownership is therefore vital as key component of adaptive capacities, for vulnerability reduction, and significant in addressing the impacts of climate change and poverty as subsequently discussed [48–50].

2.3. Usefulness of Assets in addressing poverty and adaptation

The Ford Foundation defines assets as the “stock of financial, human, natural or social resources that can be acquired, developed, improved, and transferred across generations. It generates flows or consumptions as well as additional stock” [51]. Assets are thus conceived as capital used by people in the pursuit of their well-being, availability and access of which presents opportunities or constraints for well-being [52]. Assets serve as sources of resilience and as tools of empowerment. As a source of resilience, asset ownership and access are essential for addressing vulnerability, which makes it useful

in achieving the co-benefit of addressing poverty and adapting to climate change impacts [50,53]. As an empowerment tool, ownership or command over assets enables the exploitation of opportunities in a changing environment and highlights that people are not passive victims but are actively involved in addressing the impacts of climate change [36]. Assets comprise human, social, physical, financial, natural [50,54], and cultural capitals [55]. Although poverty and vulnerability to climate change are not synonymous, they interact and reinforce each other because poverty exacerbates vulnerability and poses constraints to people's adaptive capacity, while the adaptation process may reinforce existing inequalities and foster un-equal economic structures [40,48].

Given the caveat in adaptation discourses that the poorer people should be the focus and that asset ownership plays a significant role in urban poverty reduction [50,53] and adaptation process [45,47,48]. Assets ownership and access provides a useful platform for the development of pro-poor adaptation frameworks [36,47], such as the asset-based adaptation framework developed by Moser and Satterthwaite [11]. Asset-based adaptation places focus on the everyday realities of the environmental stress experienced by people [8,56] and their actions, as opposed to a focus on suggested actions expressed in most literature on cities and climate change [57]. Through this, the framework enables an alignment of the global south's critical concern about development priority of poverty reduction with the concerns of climate change adaptation [46,49]. Furthermore, the framework's ability to display the constraints and opportunities for adaptation supports the evolution of development compatible adaptation policies [10,58,59]. These forward-looking roles make assets and the asset adaptation framework a vital analytical tool in this research. However, despite these different forward-looking roles of assets, empirical inquiry into the use of assets in adaptation are few [60] and more specifically in the Nigerian context, it is to this exciting and burgeoning literature that this paper contributes. However, because adaptation in the climate change discourse has multiple conceptualisations, clarification as to the conceptualisation of adaptation as resilience adopted in the research is the focus of the next section.

2.4. The adaptation as resilience perspective- the critical adaptation agenda and adaptation pattern

Adaptation in the climate change- development nexus is nested in three main perspectives that inform policies and actions. These are the vulnerability perspective, the disaster reduction perspective and the resilience perspective. The vulnerability perspective posits that existing interplay of social, economic, and environmental factors either inhibit or enhance a person's ability to cope with, adjust to or adapt to external stimuli [44,61,62]. From the disaster risk reduction (DRR) perspective, adaptation is conceptualized as a practice that has evolved from activities to deal with disaster, thereby placing adaptation as an outcome of environmental impacts or biophysical interaction [63]. Initial conceptualisation of the resilience perspective positioned adaptation within the DRR/hazard perspective because it centred on technical and infrastructure development, i.e., investment activities needed to develop more resilient systems/societies, indicating adaptation as power neutral [64]. However, debates on the contribution of a resilience framework to adaptation challenge the conflation of the resilience perspective with DRR. Based on the definition of the resilience perspective as "the ability of a system and its component parts to anticipate, absorb, accommodate, or recover from the effects of a hazardous event in a timely and efficient manner" [65], its proponents argue that the word 'ability' facilitates the development of resources that support the needed flexibility to respond to change [66,67]. They argue further that, unlike the DRR perspective that is directed at outcome, the

flexibility of response in the resilience perspective positions it as a process, as dynamic and as inherent in the system [68]. They explained that resilience as a process is dependent on the accessibility to resources for diverse actors and interests, and will include contestations and negotiations, which reflect the power imbued nature of adaptation [69,70].

Furthermore, Béné et al. [71] argue that the conceptualisation of resilience as an ‘ability’ indicates three things. First, it shows the capacity to adapt or transform, second, it makes agency central to adaptation as resilience, and last, it shapes the three dimensions of resilience as absorptive (stability/persistence), adaptive (aiding changes in the margins), or transformative (involving openness and adaptability) capacities. In addition, a focus on ability in the resilience approach primes adaptive capacity, described as the ability of a system to adjust to climate change, to moderate potential damages, to take advantage of opportunities, or to cope with the consequences [14]. The priming of adaptive capacity in the resilience perspective broadens the horizon of adaptation by furthering the focus on analysis of actor’s actions, decisions, and negotiations and the effects of these activities on other components in the adaptation process [70]. Thus, situating the resilience perspective as system centred, with emphasis on the process through which systems take up or resist adaptive change [69]. Through a system focus, the resilience perspective enables two things. It facilitates engaging with the opportunities, constraints, and the disruptions to a system’s adaptation process, and it enables the categorization of the adaptation process as resistance/maintenance, as transition, and as transformation [66], in alignment with Béné et al.’s [71] absorptive, adaptive, or transformative capacities.

Adaptation as resistance/maintenance envisions a continual system functioning through technology and social reorganisation that could persist until there is a breach in socially defined thresholds. Adaptation as transition is an “incremental change to social (including economic, political) and cultural relations” [66]. It is a process described as intermediary because, like adaptation as maintenance, it supports the maintenance of the prevailing order. However, the incorporation of innovation and rights that support inclusion and participation in the governance system distinguish adaptation as transition from adaptation as maintenance. The premise of adaptation as transformation is the interrelatedness of climate risks that then necessitates a radical challenge to existing social and economic structures [66]. Adaptation as transformation challenges the status quo and could be deliberate [69] or could result when a tipping point occurs [72]. Defined from the perspective of the specific actors faced with the impacts of the change [3], tipping points inform people’s willingness to act [73] and display people’s agency and capacity as a defining and distinguishing feature between the three forms/patterns of adaptation in the resilience perspective. In any context, one form/pattern of adaptation is not necessarily more appropriate than the other [71] and may not be as distinguishable practically as it is conceptually, because they could intersect and become difficult to categorize [39]. Hence, within a context, different forms of adaptation by different actors could co-exist and co-evolve or become mollified by the actions of other actors [66]. However, Pelling [66] argues that distinguishing the different forms of adaptation supports a forward-looking adaptation process in three ways. First, it indicates socially constructed thresholds i.e., the level of acceptable risk defined by social actors in the crossing of risks, hazards, and vulnerability. Second, it situates adaptation as a socio-political experience [10,74]. Last, it enables a simultaneous analysis of actors’ activities to address poverty and climate change impacts. Furthermore, situating adaptation as a socio-political process facilitates engaging with adaptation as transformation from a critical perspective described as the Critical Adaptation Agenda (CAA).

Premised on the openness and adaptability in adaptation as transformation and framed under critical theories, The CAA articulates hazard experiences as political, and dependent on contextual hegemonic development vision [10]. It focuses on the influence of the governance structure (formal/informal) on people's adaptation pathways through the entrenchment of existing or the fostering of alternative development pathways [75]. Through this, it highlights actors' actions, interests and negotiations at governance, community and individual levels, which enable a linkage of the micro and macro levels of adaptation [10,76] and overcomes the challenge of linking adaptation and development issues. Furthermore, the CAA, through its focus on structure and agency, highlights people's ability/inability to circumvent risk as described in adaptive capacity, which is central to adaptation analysis [77], and determines the adaptation pattern displayed in a context [69]. Consequently, approaching adaptation analysis through the CAA facilitates a linkage of development and adaptation issues by linking the micro and macro levels of adaptation, which makes it a useful and adopted approach for achieving our objectives. Furthermore, CAA brings together the conceptions of adaptation as dependent on people's activities within a social domain [78], and that adaptation requires access to and capacity to utilize resources [60]. However, the dependence of adaptive capacity on the availability, accessibility, and capacity to utilize resources [79], makes resources pivotal in adaptation analysis. Furthermore, the dependence on resources makes pertinent the use of an analytical framework that is focused on access to and utilization of resources, which makes the asset adaptation framework (AAF) useful. The AAF focuses on the actors' access to and use of resources, their actions/decisions/negotiations in the different spheres of a system and the interactions and intersections of activities in the different spheres. The next section discusses the AAF, its components and its analytical tools.

2.5. Analytical tool-Asset Adaptation Framework (AAF) operational framework

Moser and Satterthwaite [11] developed the Asset Adaptation Framework (AAF) (Figure 1) to aid an understanding of adaptation to severe weather in the urban context through two objectives. The first objective seeks to understand the asset vulnerability of vulnerable groups, while the second classifies and highlights the adaptation strategies at different stages of before, during and after climatic events. The framework hinges on the fact that unlike more visible extreme weather events like cyclones and hurricane, severe weather events like floods are more widespread and affect people's lives and livelihoods through an incremental vulnerability. However, the framework prioritizes not just peoples' vulnerabilities but also their means of resistance and resilience before, during and after the impact of severe weather [26]. Prioritizing the means of resilience, aids a focus on people's resources, supports engagement with them as active agents rather than passive victims [50] and positions autonomous adaptation activities as independent of government as opposed to the negative labelling of unplanned adaptation in the literature [11]. Moreover, a focus on inherent abilities enables the promotion of solutions that build on people's adaptive capacity while highlighting the wider socio-economic issues associated with climate change [60]. This establishes a close linkage between asset ownership, vulnerability, and security, and facilitates an understanding of available opportunities and sources of resilience for addressing vulnerability and enhancing/eroding adaptive capacity [50]. Furthermore, the active view on people's agency echoes the position that resources that could serve as a platform for adaptation implementation are within communities [8,13].

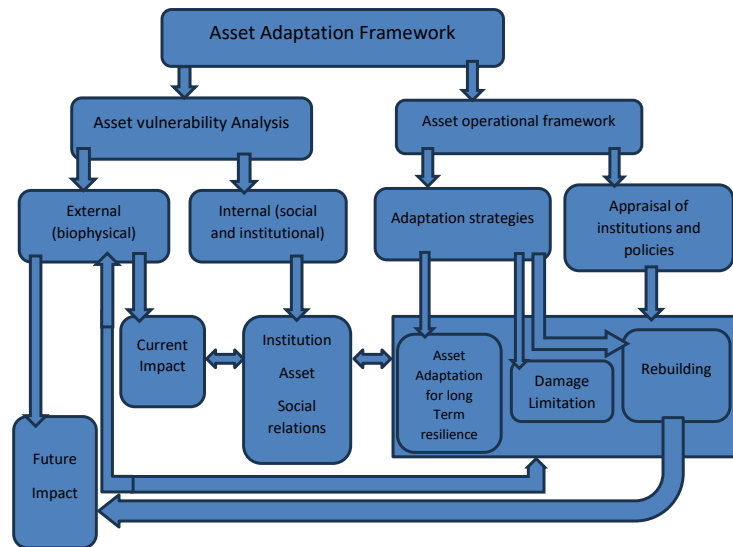


Figure 1. Asset Adaptation Framework (AAF): Adapted from Moser and Satterthwaite [11] and Moser et al. [26].

2.5.1. AAF analytical components-asset adaptation operational framework

The framework utilizes two main analytical components, the asset vulnerability analysis, and the asset adaptation operational framework to actualize its dual objectives. Although the aspect of the framework relevant to the analysis in this discussion is the asset adaptation operational framework, a brief overview of both components is given. The first component of asset vulnerability analysis seeks to understand the vulnerability of people through a careful analysis of the structural context in which they operate, thereby highlighting the interrelationship between structure, institutions, and agency and the factors that provide constraints and opportunities in the adaptation process [36]. The second analytical component, the asset adaptation operational framework, classifies and highlights the adaptation strategies at different stages of the process. The different stages include asset adaptation for long term resilience, damage limitation, and rebuilding i.e., pre, during, and after the impacts of climatic events. The operational component enables an analysis of strategies at the different arenas of actors in the adaptation process, i.e., government, community, households/individual levels, and an understanding of the extent to which the strategies align or do not align at the different levels. It also offers the potential to move beyond this vertical analytical level to a largely ignored horizontal level by examining the relationship between individual and collective actions [80]. These strategies, according to Moser and Stein [60], are contingent on some principles. The first principle is the influence of institutions, governments, and non-government actors (shaping them in ways that could be facilitating or constraining). The second principle is the interrelatedness of the different assets and their ability to exert an effect on each other and the third is the susceptibility of asset portfolios of households to both internal and external changes. The influence of these principles enables an analysis of the different adaptation patterns and possible shifts in patterns. The key tools utilized in achieving the objectives of the framework are assets that, in this context, include human, financial, natural, social, and physical assets. A brief definition of the different assets as utilized in this research is subsequently offered.

2.5.2. Analytical tools-defining assets

Social capital is “the norms and networks that enable people to act collectively” [81], with cognisance to its simultaneous role as an asset and/or liability. The analysis acknowledges and straddles the different conceptions of social capital, including networks. The network perspective on social capital stresses a vertical and horizontal flow of reciprocity and trust [81], and a public and private dimension that aids its categorization as bridging and bonding respectively [82,83]. Bonding social assets are informal relations of exchange of friendship, locality and kinship ties people own and called on in crisis. Bridging social assets is the associations/social relations and collective actions of people with different identities but shared goals or similar interests [82,83]. The human asset is conceptualized as “the knowledge, skills and capabilities possessed by humans that allow them to act and produce in given and new ways” [84]. We incorporate the positive psychology notion of ‘who am I’ [85] to explain self-consciousness and to understand human assets as participating in civic life, e.g., political asset [55,86]. Natural assets are conceptualized as the “set of unpriced environmental goods and services on which both economic processes and human and non-human life depend” [82], including land, water, and resources within them. Physical assets are fabricated tools that people/societies have command over [87]. They include items like shelter/buildings and tenure rights, machinery, personal items, basic infrastructure etc. Financial assets are the stock of savings, credit facilities, grants, remittances, and pensions that people can call on [87]. These analytical tools permit a vertical (government and people) and horizontal analysis (individual and collectives), i.e., the “relationship between consciousness, individual, and collective transformative action” [80] that highlights the ideological differences between adaptation as adjustment, as transition, and as transformation [88].

3. Methodology

The research is based on a pragmatic worldview that posits that research occurs in social, historical, and political contexts and therefore seeks to understand real world issues and applicable solutions in the specific context [89]. Hence, a qualitative approach was adopted, and an exploratory method was utilized to facilitate a holistic understanding of the complexities of adaptation, and to aid triangulation [89,90]. The use of an exploratory design enabled viewing reality through the gaze of the participants and aided the empowerment of marginalized groups by giving them a voice through research [91]. In this section, we discuss the location and method utilized in data collection.

3.1. Location

Lagos, a coastal city-state with the smallest land area of 3,577 km² in Nigeria, is richly endowed with interconnected lagoons, creeks and low topography that makes flooding a major challenge. Its megacity status emanates from its large population estimated at 24.82 million, of which 21.10 million live in the metropolitan area in 2017, but this increased to 24.70 million in 2022 [92]. Eighty-five percent of the state population reside in the metropolis, with 70% of the metropolitan population residing in informal settlements. These informal settlements are mostly in swamps and silts, vulnerable to storms and sea level rise [35], with a population of 2–4 million residents vulnerable to flooding [25]. A disparity exists between the number of Local Government Areas (LGAs) at the Federal and state

levels. At the Federal level, Lagos State comprises 20 LGAs, while at the state level, the LGAs are further subdivided and comprise additional 37 local government areas, known as Local Community Development Areas (LCDAs). Sixteen of the 20 LGAs make up the metropolitan area of Lagos city [22], two of these LGAs, Lagos Mainland and Kosofe, are close to the Lagos Lagoon (see Figure 2). The two LGAs are categorized as very vulnerable with 30% and 40% respectively of their land projected to be inundated by extreme water level events due to their closeness to the Lagoon [25].

The study sites Iwaya and Owode-Ajgunle communities are situated in Lagos Mainland and Kosofe LGAs respectively. The two sites are situated in marginal areas identified as ‘informal settlements’ that lack infrastructure and are home to a heterogeneous population of poor urban dwellers, Iwaya in particular was identified as one of the nine major slums pencilled down for urban renewal in 2013 [93]. However, they differ in terms of geographical location. Iwaya settlement is a swamp located within the city core in Yaba LCDA (see Figure 2). Owode-Ajgunle is a wetland located at the fringe of the city with the majority of the community under Agboyi-Ketu LCDA, while a part of the community is fragmented under three other local governments. These sites were chosen for two reasons. First, to understand if the spatial difference that exists between these two sites has any influence on the asset adaptation of the people; since location is identified as an important factor affecting vulnerability, impacts and adaptive capacity [8,17,27,56]. Second, the role of local governments in climate change adaptation is highlighted in the literature [8,94]. Since these sites belong to different local governments within Lagos state, and the city is a signatory to the Durban Charter on climate change action, their selection creates room for understanding adaptation at the different levels of government and for obtaining information that gives a more rounded understanding in study. The location, population and vulnerability of these sites makes them a viable context for the research.

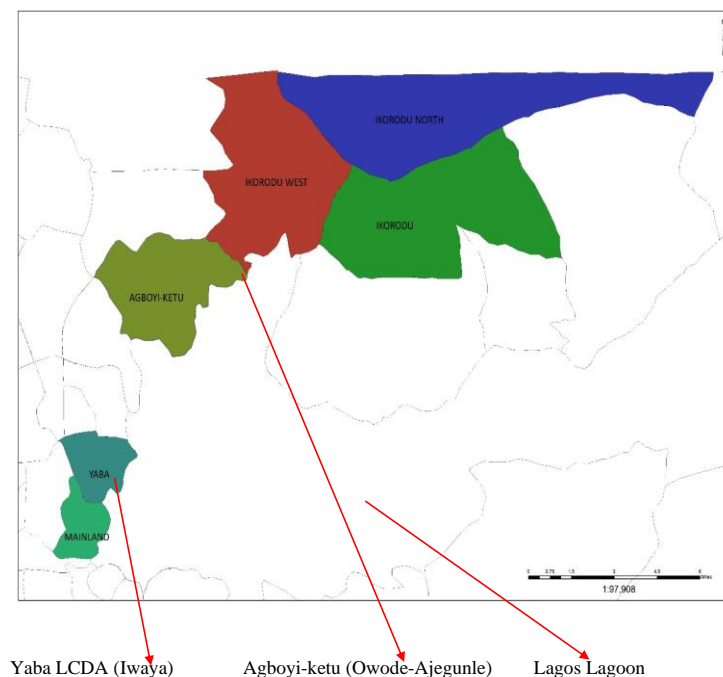


Figure 2. Map showing the proximity of the LCDAs to the Lagoon. Source: Lagos Metropolitan Area Transport Authority (LAMATA).

3.2. Data collection methods and analysis

A qualitative multi-method was used for data collection. Multiple sources of documents, from the public and private domains, useful for the research interest were analyzed. Documents were subjected to context-sensitive qualitative content analysis with multilevel sampling of words, phrases, sentences, paragraphs, and ideological stance. This provided the needed flexibility to accommodate the different types of documents and the data peculiarities (e.g., differences may exist between a policy document and political speech). In carrying out a content analysis, a blend of latent and manifest analysis strategies was used to facilitate objective and systemic identification of themes, meanings and patterns related to the research concepts and objectives. The use of reflexively approached semi-structured interviews and focus group discussion, provided platforms for understanding and investigating episodic events through the eyes/voices of those affected [90]. In view of the purposive sampling technique adopted in this research, and the need to have a diverse range of perceptions, multiple strategies for recruiting participants were utilized.

Two levels of semi-structured interviews were conducted, i.e., elites and key informants (27 interviews) and community members, including households and individuals (37 interviews). Elite and key informants are people who have controlling power over access and affairs and could influence significant information available and obtainable for the research [95]. Elites and key informants were purposively sampled for interviews based on their role in flooding events at the policy and community levels. Households within this research included couples or individuals living together as a family with or without a kin relationship [96]. As with key informants, participants were purposively sampled and were recruited after a transect walk in the communities to map out the most marginal areas. This was done to gain the daily reality of flooding impacts from the perspective of vulnerable members of the communities [60] based on the underlying principle that people are differently impacted along the axis of difference [97]. Insight into the adaptation practices of different groups was gained through eleven (11) focus group discussions. These include community leaders, women, children, the elderly, men, and women. Purposively sampled focus group research participants were accessed through the initial contact established during household interviews, through gatekeepers and through membership of associations. See Supplementary Tables for a demography of the research participants.

Collected data was transcribed, collated, reflexively read for manual unrestricted coding (inductive and deductive) that aligns with predefined concepts. Subsequently, the collected data was subjected to computer-assisted analysis with the NVIVO software after two weeks of detachment from the manually generated codes. The manually generated and computer assisted codes and analysis were compared, and codes from both methods were observed to be similar, indicating that the assigned codes would be assigned irrespective of the analytical technique used. The emerging themes were first aggregated together for intra-method comparison to identify themes and structural meanings relevant to the research concepts. The result from each method was then triangulated to check for patterns and explanations relevant to theory, literature, and other research. The next section discusses the findings of the research; however, all the names are pseudonyms¹.

¹ A deterministic approach was used in the pseudonymisation of the research participants.

4. Everyday adaptation to flooding–findings

4.1. Asset mobilization and adaptation strategies at the micro levels

Tables 1 and 2 below summarize the assets protected and assets mobilized pre and during flooding events, while Tables 3 and 4 highlight post-flooding strategies for households and communities, respectively, the discussion below elaborates on the findings.

4.1.1. Pre-flooding strategies

Households in both communities targeted physical asset protection prior to flooding. Like strategies utilized in informal communities in Ghana [98], Dar-es-Salam [99], and India [100], households with financial means raised ground levels of homes and incrementally developed buildings. Common to both communities are the use of tangible materials to create pathways to ease movement during flooding. Jokotola, an Iwaya resident, explained that,

“...even for a surge that is yet to come, we are already contributing towards the construction of an elevated wooden walkway. So that when the flood comes, those of us that want to go to the backyard will be able to walk over water...” [Household interview with Jokotola, Iwaya].

This commonality notwithstanding, materials used differed based on specific local vulnerability. Within Iwaya, the Isale-Iwaya area, through communal taxing, used broken blocks for piling moulds on roads (see Figure 3 below), while Ago-Egun area used sandbags and wooden walkways (see Figures 4 and 5 below) indicating that prior to flooding, activities target the physical environment [101]. Furthermore, differences existed in the drivers of the sensitization activities undertaken in both communities. The driver for Owode-Ajgunle was the Lagos Wetland Community Stakeholders’ Forum (LWCSF), a community-based organisation, but for Iwaya, the government instituted Community Development Associations (CDAs), were the drivers. In addition, social learning, the horizontal transfer of information and local knowledge was a prominent strategy in both communities, the account of Olatokun of Owode-Ajgunle is indicative.

“...being the first to put a building in the area... all those that later come in... I often encourage them to ensure that the foundation of their houses is high such that when the floods come it does not enter the houses.” [Olatokun, LWCSF leader, Owode-Ajgunle].

Beyond social learning, in both communities, children in more vulnerable neighborhoods gained adaptive skills like swimming, as Reuben, an Iwaya waterfront resident explained.

“... thank God, there is no life being lost. Why? Because most of the children can swim very well and water is not a problem...” [Individual interview with Reuben, community activist and school board member, Iwaya].

These groups of residents mobilized their human assets i.e., skills acquisition/knowledge transfer, ahead of flooding events for disaster prevention.

Table 1. Asset adaptation strategies at the micro levels before flooding events.

Strategies	Household micro level		Community micro level			
	Asset(s) protected	Asset(s) mobilized	Strategies	Asset(s) protected	Asset(s) mobilized	
fortification of physical structure	physical	financial	creation of pathways to facilitate movement during flooding	physical	physical	
household wooden walkways	human	physical	clearance of drainages	physical	social	
drainage clearance	physical	human	building of communal walkways	human	social	
sand filling to raise floor level	physical	physical	sensitization activity	human	human	
social learning-information sharing	physical/human	Social and human				
adaptive learning	human	human				

**Figure 3.** Filling with broken blocks at Isale-Iwaya neighborhood.**Figure 4.** Filling with Sandbags in Ago-Egun neighborhood.



Figure 5. An example of a constructed communal wooden walkway.

4.1.2. Strategies during flooding events

In both communities, most adaptation activities during this period occurred at the household level with a focus on the protection of people and personal possessions. In resonance with the findings for Alajo, Ghana [27], and Khulna, Bangladesh [102], physical assets were used for damage limitation through an upward movement of people and goods on elevated platforms like beds, tables, and shelves for safety. When upward movements become inadequate, temporary, or permanent relocation to friends, neighbours and family becomes the norm. However, the mobilization of social networks differed between household and community. The use of bonding social assets through relocation to friends and family by households facilitated damage limitation, as the excerpt of the discussion with children from Iwaya shows.

Facilitator: So, what do you and your parents do when flooding occurs?

Melissa: They sometimes take us to someone's house for us to sleep there, while they will use bowls to bail out the water.

Lekan: They often take us to their friend's house to spend the night and go back home in the morning.

Muftau: My Mum, when the rainy season is here, she takes us to our grandma's house.

Ifeoluwa: My Dad takes us to his friend's house to stay until the house is fixed.

[Group discussion with children from the Iwaya community]

In the community, people mobilized and built bridging social assets for damage limitation as shown in Hafsat's statement below:

"Yes, we put a net there [house decking] against mosquitoes, the six-foot mattress was what we put there for the whole family. Even then, all the people that didn't have anywhere to go, that did not have family around, those boys and the family men, everybody came to us, and they were living with us on the decking." [Hafsat, women leader, Owode-Ajgunle]

This building of social assets displayed how, in emergencies, shared experience of trauma challenged prior socio-cultural constructions of spaces as private or public. In addition, response to externally driven relocation differed between tenants and house-owners in Owode-Ajgunle. While most resident house-owners rejected the evacuation assistance of the Lagos State Emergency Management Agency (LASEMA), most tenants accepted. Furthermore, at the household level, adjustments to daily activities like changes to food consumed (e.g., feeding on packed food) and dressing pattern (e.g., the wearing of rain-boots) recurred as strategies in both communities. Other activities adjusted were mobility related i.e., avoidance and timing of movements to minimize exposure. In similarity with findings from [27,101], people utilized vigilance and adjusted sleeping patterns to protect themselves from sudden surges, as Dosu, an Iwaya chief, explains:

“...for us when the season is around, we also prepare and are aware that the season has come. So, there is no case of sleeping deeply, you have to be on alert like a soldier that, at any time, the thing can come...” [Dosu, community head, Iwaya].

The strategy highlights the intersection of social and human assets. Similar asset intersection occurred in other strategies like bailing water, highlighted by Melissa above, and the clearing of blocked drains for damage limitation. A strategy common in other flood prone areas of Lagos [12] and Ghana [27], water bailing involves the use of containers to scoop water from within homes for disposal. Although drainage clearance occurred across the temporal dimensions, at the micro levels, during flooding, its use by the community was sparse due to a focus on household damage limitation, but when used, the strategy coordinators differed for the two communities, i.e., LWSF for Owode-Ajgunle and CDAs for Iwaya. Furthermore, in both communities, the use of canoes to ferry people and children to schools was a strategy specific to the more vulnerable areas. Notable during this period is that although an intersectionality between human, physical and social assets occurred, human and social assets were more significant, and bonding social assets were critical for households.

Table 2. Asset adaptation strategies at the micro levels during flooding events.

Strategies	Households		Strategies	Communities	
	Asset(s) protected	Asset(s) mobilized		Asset(s) protected	Asset(s) mobilized
bailing and discharge of water	physical	physical	evacuation and ferrying of children with boat	human	physical
upward movement of people and goods	human	Physical	clearance of blocked drainages	physical	social
changes in consumption dressing, movement pattern, and vigilance	human	human			
drainage clearance to clear blockages	physical	human			
relocation-to friends and family	human	social			
boat steering skills	human	human			

4.1.3. Post-flooding strategies- visible/externally directed

Two levels of post-flooding strategies were evident and discussed as visible/externally directed, and psychological/internally induced. A major externally directed strategy at the household level was repairs like refilling homes and raising house heights. In Iwaya, a resident explained that after several attempts at refilling and raising walls, he decided to construct another floor above the property (see Figure 6 below). Oftentimes, people seek funds from microfinance institutions, as Violet of Owode-Ajegunle explains,

“When the flood recedes, people often go borrowing to rebuild their structures; they often borrow from microfinance institutions. It is also sometimes difficult to repay the money borrowed from the microfinance institutions after the repair of the homes and this often results in high blood pressure for some people.” [Violet, political activist, CDA executive, Owode-Ajegunle]

Inability to repay limits future access to funds, thus enhancing exposure and vulnerability, and hampering peoples’ adaptive capacities. At the community level, collective activities were two-fold, the first being the use of sand for refilling/repairing of communal spaces. The second was information sharing, displaying the overlap of strategies between the temporal dimensions, i.e., pre- and post-flooding events. Although in both communities, households and neighborhoods use sand for refilling, people in more vulnerable neighborhood mine sand from surrounding water bodies (see Figure 7 below), which reduces dependence on financial assets and underlines the need for intra-community disaggregation. In general, it is noteworthy that while the mobilization of financial assets was key at the household and community levels, its effectiveness at the community level required the mobilization of social assets.



Figure 6. Construction over existing sunken house.



Figure 7. Mining sand for refilling floors.

4.1.4. Post Flooding strategies-psychological/internally induced

For households and communities, psychological and internally induced post-flooding strategies were evident. These strategies are manifested based on beliefs exhibited through faith or fate and through social experiences that include claims of belonging and place attachment. However, these issues are interconnected as they are reflective of people's values (i.e., cognitive constructs) that inform and justify people's actions, moral judgments, attitudes in different situations [103]. For instance, the excerpts below are indicative of the internally induced post-flooding strategies.

“We are living in peace, and I pray in the name of Jesus that peace will not elude us... Normally, anyway, when things are going well, prayer is needed, likewise, when going badly. In every part of Lagos, there is one specific issue or the other for different communities, but then we will continue to pray to God that so-and-so thing that we do not want. Please help us to take it away. There is nothing in the community that is beyond perseverance. (Charity, Female, Owode-Ajegunle).”

“There is nothing it (floods) does to us, we have become used to and accepted it. May God not allow deprivation to be part of one's life. There is nothing we can do about it. It is what befalls one that one accepts as one's destiny, but if it is such that when you move in, your children become sickly. One can then say it was after we moved in and experienced the storm surge that our children became sick. May God not allow one to live a poverty-stricken life; our bodies have become accustomed to it. We are used to it. (Jokotola, Female, Iwaya)”

These excerpts express the use of faith and fate as strategies that facilitate people's adaptation to flooding. These accounts give credence to the argument that belief and faith can aid coping and foster quicker recoveries during recurring hazards and disasters [73,104]. They highlight people's acceptance of the situation as their fate and staying-on coping mechanism through an existential and explanatory framework that situates their flooding experiences as external and devoid of their agency, a form of 'religious determinism' [103,105]. This explanatory framework then supports the utilization of prayer to help with perseverance, protection, and prevention of future occurrences [106]. The belief induced actions underline religion as a coping mechanism both in the prevention of doom and despair and as useful for managing post-traumatic stress disorder (PTSD) that could emanate from hazardous experiences through the provision of a higher purpose of life [107].

Furthermore, social experiences including claims of belonging and place attachment were other forms of internally induced post-flooding strategies as expressed in the excerpts below.

“To be sincere with you, since I came in I can more or less say, we hardly experience crime like some other areas...that is the reason why you see me here.” (Adesanwo, male, Owode-Ajegunle)

“...some of us were born here, some came here more than 40 years ago, over 100 years. So, the fact is that we cannot leave the place, so when the water comes and goes, we turn to organise ourselves back to our fishing job.” (Jolabi, leader of Ilaje ethnic group, Owode-Ajegunle)

“So, I thought of it that there are some tenants that rent two rooms in someone else’s house. He might even have built a house with four flats and still have the thought that in that room there is an angel making things happen for him and therefore decided he would not relocate from the house. That is the reason why I have decided not to leave this house...” (Olude, elderly person and leader of the Ilaje ethnic group, Iwaya)

Here, people use the tripartite dimensions of place attachment, i.e., place, person, and process, for rebuilding and as a source of resilience. For instance, Adesanwo and Jolabi’s statements highlight two functional aspects of place attachment, i.e., the physical dimension of space (i.e., for security or pursuance of peoples’ goals), and the social aspects (i.e., sense of belonging, identity, and self-esteem) [108,109]. Jolabi’s statement typifies the social aspects of place attachment used by residents to resist eviction and relocation at the micro level, in line with the position that during hazards place attachment can become a means of resistance [73]. Olude’s narrative displays a spiritual connectedness that highlights the process dimension of place attachment as a source of resilience and for rebuilding.

Such connectedness is also revealed in communal and ethnic claims to spaces that use the social ascription of place attachment, expressed through recurring collective identity tropes in statements like:

“We, the Ilajes, live on water; everyone knows that the Ilajes live on water.” (Ayolola, female, Iwaya)

“During that period, we were on the TV, and it was suggested that we should be relocated from this locality, and we responded that we cannot be relocated from this area. This is the land of our heritage and this water is not a problem considering the fact that we were born and raised in water.” (Kareem, Community Leader, Owode-Ajegunle)

“Where do we park our boats if we are given houses on the land? We are like fish; they should leave us where we are. We are a family with fish. Our lives are like fish. Look at this fish, if we bring the fish to land it will die, as you have seen this fish die.” (Dosu, Community Chief, Iwaya)

Furthermore, in the adaptation process at the communal level, the people mobilized the positive psychology of self-consciousness in human capital based on their worldview, values and culture to evolve shadow networks that used political reactive resistance to engage the authorities [110] as highlighted in the statement of Jibola, a community leader and executive member of the LWCSF in Owode-Ajegunle below:

“The issue of flooding is what pulled us together here, we now realise we are going nowhere. In fact, if we allow the flood to take over, we cannot afford to take land in Lekki or take land in Ibafo, so we had better stay here and fight it out”. (Jibola, community leader, Owode-Ajegunle)

The development of such self-consciousness underlines the position that psychosocial dimensions influence actions and decisions on adaptation [73,111–113]. However, the spaces of engagements, categorized as invented or invited [114], differed between the two communities. The LWCSF of Owode-Ajegunle utilized invited spaces through formal meetings and negotiations in its

engagement with the authorities, while for Iwaya, the Ijaw and Ilaje ethnic-based shadow network used invented spaces of insurgency.

Table 3. Asset adaptation strategies at the micro level of households after flooding events.

Household micro level					
Externally directed asset adaptation strategies			Internally motivated asset adaptation strategies		
Strategies	Asset(s) protected	Asset(s) mobilized	Strategies	Asset(s) protected	Asset(s) mobilized
rebuilding filling and raising of floor	physical	physical	social experience	human	human
Sand mining from nearby water bodies for residents in more vulnerable areas	physical	natural	positive psychology identity, fate, faith, autochthony, and place attachment	human	human
private funds and financial institution	physical	financial			

Table 4. Asset adaptation strategies at the micro level of communities after flooding.

Community micro level					
Externally directed asset adaptation strategies			Internally motives asset adaptation strategies		
Strategies	Asset(s) protected	Asset(s) mobilized	Strategies	Asset(s) protected	Asset(s) mobilized
sand filling of roads and communal areas	physical	physical	Influence of social experience	human	social
sand mining from water bodies to fill communal area in more vulnerable areas	physical	natural	Use of positive psychology of critical self-consciousness, which led to the emergence of shadow networks in both communities and engagement with the macro level authorities	human	human

4.2. Asset mobilization and adaptation strategies at the macro levels

Table 5 below summarizes the asset adaptation strategies at the macro levels, before, during and after flooding events, expounded in the discussion below.

4.2.1. Pre-flooding strategies

Early warning i.e., information dissemination on impending flooding was a key pre-flooding strategy used across all three levels of governments (local, state, and national), in addition to drainage enforcement, clearance and maintenance. This is displayed in the national policy on environment guidelines that “urban growth including drainage shall be enforced” [115], while a Lagos State document states the pre-flooding activity as the “Pre-rain maintenance dredging of primary channels

and mid-rain maintenance of secondary collector drains as well as tertiary/road drains” [116]. At the municipal level, the provision in Section 12 (1a) of the Environmental Sanitation Law that “Every person shall clean and maintain any drainage in the frontage, sides and rear of his tenement or building” [117] echoes drainage cleaning in the law’s section 1, indicating a drainage focus. Drainage focus resonated in the narratives of the council elites, typified in the excerpt of Huntonu, Yaba LCDA Management personnel.

“So, we, apart from the monthly environmental sanitation where people are by law supposed to come out every end of the month to clean their environment and de-silt the drains. Apart from that, there are some drains that are heavily silted that the local government have to come in to do that on its own...now we are supposed to start the exercise by March-April, before the rains come.” [Huntonu, Management staff of Yaba LCDA, Lagos State]

Notably, pre-flooding strategies at the different levels of governments were set within disaster risk reduction (DRR) and as Table 6 shows, there is similarity with the micro levels in the protection of physical assets, but the key assets mobilized were physical and human assets.

Table 5. Asset adaptation strategies at the macro levels of authorities, before during and after flooding events.

Period	All levels of state actors		
	Strategies	Key asset(s) protected	Key asset(s) mobilized
pre-flooding events	drainage clearance sensitisation and awareness creation	physical	physical human
during flooding events	drainage clearance utilized by the state and local authorities. evacuation of people at Owode-Ajegunle. welfare provision (shelter, school) for evacuated residents of Owode-Ajegunle provision of funds by national and state government for evacuated residents of Owode-Ajegunle	human	physical financial
post flooding events	eviction and relocation threats	physical	physical

Table 6. Asset adaptation strategies at the micro and macro levels before, during and after flooding events.

Period	Micro level Asset Adaptation		Macro level Asset Adaptation	
	Assets (s) protected	Asset(s) built/mobilized	Asset(s) protected	Asset(s) built/mobilized
pre-flooding event	physical human	social human financial	physical	physical human
during flooding event	human physical	human physical social	human	physical financial
Post flooding event	physical human	physical financial human social natural	physical	physical

4.2.2. Strategies during flooding

During flooding, similar to other findings, activities at the national, state, and local government levels were welfare focused and utilized evacuation and selective provision of infrastructure [118–120]. Selective provisions manifested within Owode-Ajgunle community where residents domiciled under Isheri-Ikosi LCDA received planks from local authorities to construct walkways. At the state level, during the 2011 flooding, funds from the national government to flooded states, including Lagos, facilitated the evacuation and temporary accommodation of some Owode-Ajgunle residents at the Agbowa relief camp. Goke, a top bureaucrat of the responsible agency, corroborates this in the quote below.

“...their response has been good because we carried them along, because when the flood disaster occurred, ‘...’ we camped them at Agbowa relief camp ... we tried to cushion the effect both physically, psychologically and socially.” [Goke, Head of Lagos State Government Agency]

However, support for Iwaya residents was limited because attempts at engaging with the authorities were gated, which restricted negotiation spaces. This is perhaps attributable to a reposition of flooding problems in people’s lifestyles by policymakers. The quote from Razaq, a top environment ministry bureaucrat, is indicative.

“Where they encounter operational river flooding, overflowing of the rivers all the time, but the people are used to it anyway because they believe it is part of the rituals of their lifestyle.” [Razaq, a top bureaucrat at the Ministry of the Environment, Lagos State]

Such perceptions aid persistence/incremental adjustment pattern by drawing attention away from alternative risk sources and supporting an othering of people for what they do/who they are. Although physical and financial assets were mobilized to address flooding, similar to the micro level, the key asset protected was the human asset (see Table 6).

4.2.3. Post-flooding strategies

As with pre and during flooding, post-flooding strategies at the three levels of government were set in the disaster risk reduction/management conceptions. Technical activities like eviction and relocation were the focus of policy. For instance, Guideline 31 of the Federal Ministry of Environment’s technical guidelines on flood control states “Government development agencies (e.g., LGA/State) shall prohibit the siting of essential facilities and major structures in identified flood hazard areas and drainage alignments” [121]. This policy manifested in the relocation of schools (primary and secondary) and a refusal to put a permanent health care infrastructure at Owode-Ajgunle by local and state authorities, typified in the excerpt of a group discussion with Owode-Ajgunle women.

Charlotte: Yes, that was what they were saying to us. They said it to my own face.

Hafsat: That was what they were saying to us, which should not be.

Facilitator: Was that at the local council office?

Hafsat: Yes, it was at the council that it was said that only things that can be taken out easily should be placed in the community. If you get to Idera, you will see a health centre there; you will observe that the health centre is constructed with a container... They say if they get the signal from the government that the people will be evicted, they will just easily pick out the container. Are we not human beings as well?

[Group discussion with women at Owode-Ajgunle]

The discussion with the women exhibits the local government conformity with the federal policy, in alignment with the federal policy statement that “the implementation of environmental policy relating to erosion, flood and coastal zone management shall require linkage at the three levels of government” [115] (i.e., Federal, State and Local Government levels). Significantly, the policy on eviction and insistence on removable infrastructure undermine the inclusive access to basic infrastructure, maintain status-quo and sustain incremental adjustment pattern. Notably, the physical assets mobilized post flooding at the macro levels is one of the assets mobilized at the micro level (see Table 6).

5. Discussion

5.1. Asset adaptation strategies- concordance/dissonance between the micro and macro levels

The findings presented above highlight the assets protected, mobilized, and utilized in adaptation activities before, during and after flooding events at the micro levels of people and macro levels of state actors and policies. As table 6 shows, despite the consistent micro-level protection of physical and human assets, physical assets were the most protected and mobilized across the temporal dimensions at both levels, reiterating the position that physical asset fortification is important for adaptation [101]. However, the dependency of asset fortification on access to financial resources at the micro levels suggests a higher vulnerability for poorer residents. Furthermore, its dependence on previous experience and information/skill transfer underlines the role of experiential learning [122,123] and social networks [124] in mitigating risks. However, at the macro level, cognizance of the role of human and social assets in adaptation was limited across the temporal dimensions despite the criticality of social assets during flooding at the micro level. This inattention resulted in mismatch of assets mobilized and prioritized during flooding. For instance, the prioritisation of social reorganization and financial support at the macro level was in dissonance with the prioritisation of social assets at the micro level. Moreover, during flooding, beyond protecting lives, social assets enable social cohesion, and the maintenance of social roles, structure, status, and self-esteem [125]. The role of social assets in community cohesion necessary for implementing adaptation programmes underscores the need for cognizance to social assets in adaptation planning and implementation. For instance, the inward movement of neighbours into private spaces, besides building bridging social assets, resulted in a fluidity between public and private spaces that has implications for space definition in risk management policy. Besides, such inward movements point to neighbourly expectations that result in condemnation if unmet and commendation when met [126]. Such issues could affect community cohesion necessary for the emergence of shadow networks that can influence the adaptation pattern.

5.2. Asset adaptation strategies- implication for adaptation pattern

In Owode-Ajgunle, the emergence of the community organization, LWCSF, aided the coalescing of individual consciousness, which facilitated a move towards transformation to support the argument on the influence of psychological processes in transformational adaptation [111–113]. The community-based organization used invited spaces to challenge political and bureaucratic actors to legitimize access to land and reclaim the people’s de-jure citizenship rights, supporting the notion that a strong informal context could provide a platform for transformative adaptation [127]. For Iwaya, the

situation was different because community consciousness emanated from identity politics and was limited to fisher folks that identify as Ilajes, Eguns, and Ijaws. This group asserted their citizenship rights through protests on the death of an Egun chief resisting government eviction. Although insurgent citizenship, i.e., direct action to assert rights and to suspend and replace the legal/illegal divide with discourses of social justice/human rights [128], gave the community respite from eviction, the community's de-facto citizenship and land status remained unchanged, setting the adaptation pattern as incremental adjustment. The differences in the pattern of adaptation underscore the influence of communities' social dynamics and social capital in building resilience to address climate change problems [129,130]. Explanations for the different adaptation patterns are attribution for causality and the difference in community cohesion. In Owode-Ajgunle, the residents attributed their flooding experiences to unjust action of governments and government institutions through the opening of the Oyan dam by the Ogun-Osun River Basin Authority resulting in the emergence of the LWCSF, while Iwaya residents interpreted their flooding experiences as a natural phenomenon that limited collective proactive actions. The differences in interpretive frames had implications for community cohesion, because while Owode-Ajgunle used a common front to champion its access to entitlement, the Iwaya community's fragmentation along ethnic lines circumscribed access to entitlements.

The difference in adaptation notwithstanding, the emergence of the shadow networks supports the notion that shadow networks could provide alternative means for socio-ecological management and understanding this is important for policy [131,132] mined people's agency and made adaptation projects ineffective, as shown in the passive resistance to the project of the state government perceived as disguised eviction by homeowners at Owode-Ajgunle. This not only hampered the effective implementation of the project but also undermined the social contract through the loss of collective consent from a lack of state/citizen trust [133] and accentuates the disagreement on the positioning of vulnerable groups as passive victims [50,77]. In addition, inattention to human assets at the macro level limits an understanding of the use of identity and autochthony through cultural claims of peculiarity and social claims of ancestry to assert claims to space on two fronts. First, the use of the claims for long-term resilience and for rebuilding is veiled [134,135]. Second, despite autochthony's slipperiness and limited ability to enable rights [136,137], its use is veiled in contexts like Nigeria where competing narratives of indigeneity and citizenship co-exist as legitimate rights to entitlements and facilitates access to resources [138,139]. Moreover, because autochthony recurs intensely with people seeking some sense of security in the face of risk and uncertainty [137], macro-level actors can misconstrue it as the rational decision of people to inhabit hazard-prone areas. This naturalizes the flooding problem through a strong construction of vulnerability that reposes responsibility on affected people [140] and supports reducing rather than preventing risks.

The reposition of responsibility has implications in three spheres. First, at the micro level, it weakens people's adaptive capacity in the long term because expectations on state protection, critical in mediating climate impacts and promoting longer-term adaptation are constrained [73]. Second, at the macro level, it dismisses other causes of risk generation [141], aids systems and status-quo maintenance that could engender adjustments or at best offer a transitional pathway of welfare provision [66]. However, welfare support can become immunological, sustaining patterns that build the people's absorptive capacity for future doses of inequality and environmental degradation [142]. Third, institutional rather than local priorities are affirmed [143], which constricts spaces for alternative socio-political change, and locks-in transitional adaptation by maintaining existing structural relations [66] as shown in the maintenance of structural relations despite an inclusion in

health care access for Owode-Ajegunle residents. As Fayombo [144] argues, inattention to structural issues in adaptation veils the discourses, values and interest that aids risk generation and debilitates citizens' recognition and participation parity required for entitlements. However, as the LWSF showed, despite the adjustment/transitional stance at the macro levels, a demand for recognition aided a shift towards a transformative pattern, supporting the concurrent occurrence of multiple patterns within a context [71]. Although the adaptation activities in the two communities were similar in many respects, the difference in adaptation outcome based on a demand for recognition through human assets limits generalizing the findings as wholly representative of Lagos and draws attention to group variations within a context [145]. Underlining the influence of contextual issues and social interactions in shaping different outcomes between communities within the same political and geographical space. An exploration of multiple sites across the state would support generalization and enhance policy targeting; this notwithstanding, the findings highlight the mechanism used by vulnerable groups to shape the political economy of their vulnerabilities and security. An understanding of these dynamics is essential to address the possibility of transformation in the adaptation process and to understand what might facilitate it in a specific context and what might mollify it. Furthermore, the need for transformational adaptation for obtaining the co-benefits of adaptation and development is agreed in literature and some factors that could support transformational adaptation are proposed. However, the specific modality for achieving this and the tools for analysis are not properly articulated, a gap addressed empirically through the use of assets to offer insight into what elements support transformation and how these elements are configured. This is particularly significant for developing countries to address the competing priorities of development and adaptation and necessitates further exploration of experiences in other cities across Nigeria and other sub-Saharan African urban centres for a more practical context-sensitive adaptation policy. Cross comparison between cities and cross scales, sub-region and regional comparability could help tailor policies that will facilitate a better targeting of adaptation funds.

6. Conclusion

We explored the adaptation strategies for flooding at the micro level of communities and the macro level of authorities in two communities in Lagos to highlight the assets protected and utilized in three temporal dimensions, areas of concordance/dissonance, and the influence on the adaptation pattern. Although the assets prioritized at the micro and macro levels were similar prior to flooding, they differed during and post-flooding events. There was a temporal mismatch in financial asset utilization between the two levels, and a lack of cognizance of the use of human and social assets at the macro level that hindered adaptation project implementation. At the micro level, the strategies displayed ahead of flooding show a planned approach that challenges the notion of autonomous adaptation as unplanned. Furthermore, during flooding events, the inward movement of neighbours into private spaces blurs the public/private divide in space definition with implications for community cohesion and disaster management. Moreover, during flooding, social assets (bonding and bridging) are important in coping with flooding. After flooding, the importance and significance of autochthony and place attachment by residents of more vulnerable areas in response to risk require further exploration and underlines the need to disaggregate groups within a community.

The three periods, at the macro level, through a repositioning of responsibility, were set in disaster risk reduction i.e., a focus on technical and social reorganization that promoted welfarism, foreclosed other sources of risk and hampered a transformative pathway. The ability to attain a shift towards

transformation by the shadow networks that evolved from flooding problems depended on the spaces of engagement with the authorities, stressing the role of self-consciousness of human assets, and spaces of negotiation. However, the factors aiding space creation at the macro and micro levels, the mechanism or factors at the institutional levels that facilitate invited spaces, and how such spaces are negotiated at the micro level to facilitate de-jure citizenships and transformational adaptation needs further investigation. Additionally, a shift in status-quo for Owode-Ajegunle residents through land access legitimization occurred concurrently with socially differentiated healthcare access. Indicating that within a system, multiple patterns of adaptation can co-exist depending on resource access and mobilization. An understanding of the period dependent, specific response of affected people aids attention to group variation in different cities, which can guide policies, align actions, and target adaptation financing to enable a harmonized and sustainable adaptation. Overall, the paper, through the use of multiple strategies at the micro-levels, challenges the dichotomized categorization of adaptation (i.e., planned vs reactive) in the literature and highlights the need for a rethink.

Use of AI tools declaration

The authors declare that they have not used Artificial Intelligence (AI) tools in the creation of this article.

Conflict of interest

The authors declare that they have no conflicts of interest.

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