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Climatic disasters within a flood-prone coastal slum in Lagos: coping capacities and adaptation prospects

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Abstract

Purpose – Climate impacts are a significant challenge in slums and informal settlements, most of which are located along the coast. This article aims to show coping strategies and flood adaptation opportunities through the case study of a coastal slum in Lagos, Nigeria.

Design/methodology/approach – A mixed-method approach is used in Idi-Araba settlement, Oworonshoki, Lagos – the case study area. Data collection involved semi-structured interviews with 15 purposively selected residents and a survey (sample size = 300 residents). A town hall meeting was convened to disseminate the findings and gather feedback from the community.

Findings – Being an informally developed settlement, flooding affects the poor-quality buildings – a situation made worse by absence of infrastructure and services. Coping with flooding involves structural strategies (raising building's foundation, re-roofing, sand-filling the surrounding, etc.), failed attempt through green infrastructure, nonstructural measures through dietary pattern, dressing, etc. These measures emanate from self-help and community efforts, attesting to notable social capital in the study area. They are minimally effective and limited, which highlights adaptation gaps and opportunities.

Research limitations/implications – This study calls for transformative adaptation, beyond the current coping and maladaptation. It argues that local strategies need to meet with innovative substantive external initiatives from the state and third sector.

Originality/value – This study considers the single case of a coastal settlement in Lagos. This focus allowed detailed examination within a representative settlement, much unlike city-wide, cross-settlement considerations in many other studies. It provides additional empirical evidence on limitations of self-help flood coping measures and adaptation prospects in the often overlooked low-income, informal urban sector.

Keywords Flooding, Built environment, Building failure, Climate change, Waste management, Retrofitting

Paper type Research paper

Introduction

Climate impacts are a significant challenge in cities, many of whom are located along the coast. Scientific evidence, presented within the latest Intergovernmental Panel on Climate Change's (IPCC) sixth assessment report (AR6) written by Oppenheimer *et al.* (2019), is clear that sea level is rising, resulting in increased flooding in coastal communities. These impacts are palpable in areas regarded as slums and informal settlements in developing countries. Estimates show that over 50% of urban residents live in slums and informal settlements in Sub-Sahara Africa, with many located on the waterfronts, low-lying areas (below sea level) and riparian corridors. In Lagos, for example, over 60% of the population are estimated to

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live in slums and informal settlements. In 1981, 42 slum communities were identified within Lagos metropolis (Lagos MDG, 2006), but these have increased to over 120 at present. Most of these slums are found in the oldest settled areas within the Lagos mainland, especially in marshy, waterfront areas and near the lagoons (Adelekan, 2010). In these places, housing conditions are poor, with little or no access to basic infrastructure (Mathema, 2008). Many houses get flooded regularly, and the vulnerability to impacts of extreme weather events is high.

There is growing recognition that global green agendas driving climate adaptation must engage the informal urban sector (Brown and McGranahan, 2016). Data scarcity and undocumented informal socio-ecological processes within slums and informal settlements motivate attention to this urban sector (Bai *et al.*, 2018). Poverty reduction, climate adaptation and disaster risk reduction all share the interest in understanding local-level responses within slums and informal settlements, especially those in coastal locations. Adaptation strategies are limited when they preclude local knowledge and community-based initiatives (Mikulewicz, 2018). Guided by the question, "how do slum residents cope with flooding impacts, and what prospects for strengthening adaptation," this study shows responses to climatic disasters (flooding) through the case of a coastal slum in Lagos, Nigeria.

After the introductory part of the article, a review of literature engages the concept and examples of coping and adaptation within the context of slums and informal settlements in Africa. This is followed by information on the study area and data collection methods. The diverse coping strategies are presented in the results section. Areas of adaptation needs and opportunities are presented and discussed thereafter.

Coping and adaptation in context of low-income urban environment

The concept of adaptation, which has a long history in natural and cultural sciences, has now gained traction in climate change studies within the past few decades. The IPCC defined adaptation as "adjustment in natural or human systems in response to actual or expected climate stimuli or their effects, which moderated harm or exploits beneficial opportunities" (IPCC, 2001: 982). The definition informs perspectives on adaptation in climate change studies and its application in the field of human settlements.

"Adaptation" and "coping" are often used interchangeably and compared together within responses to climate variability and vulnerability. Nevertheless, the two concepts differ. While coping often generally involves short-term processes, adaptation refers to more long-term initiatives. Bringing both concepts together in the context of climatic change, Yang (2019:28) defined adaptation as the "long-term process of adjustment to actual or expected climate and its effect including transformative changes"; and coping as "short-term direct actions to minimize negative impacts of specific climate events." In relation to floods, both coping and adaptation involves flood fighting and flood mitigation before, during or after flooding at the building, neighborhood or citywide scales. Flood fighting and/or flood mitigation involves structural (e.g. sandbags, dikes and levees and drainage channels) and nonstructural measures (e.g. insurance, patrolling and migration) (Jongman, 2018).

Adaptive capacity refers to inherent capacity of a system, for example, a neighborhood, household or individual, to undertake actions dealing with the expected and unexpected impacts associated with climate change (Satterthwaite, 2007). The links between coping, adaptation and adaptive capacity point to the need for improvement in capacity to deal with impacts of (climate) change in the short and long term. This is important because adaptation is a *process* as much as an *outcome*. If repeated coping strategies does not improve the

situation over time, it can become maladaptive, enhancing rather than reducing vulnerability to climate impacts (Schipper, 2020).

The number of studies conducted on adaptation to and/or coping with the impacts of climate change within slums and informal settlement in Africa is low, compared with Asia for instance, but they are steadily growing. Documentation of individual and collective actions in response to flooding within informal urban communities in Africa is still inadequate. This must have led Dobson (2017) to argue that community-driven improvements in informal settlements are underutilized for risk reduction and resilience building. Some of the available studies reveal how low-income households cope with climate challenges such as flooding, windstorm and sea level rise (SLR) (see, for example, Adelekan, 2010; Agbor, 2013; Adegun, 2014; Thorn *et al.*, 2015; Amoako, 2018; Mbuya *et al.*, 2018; Cobbinah and Kosoe, 2019; Udelsmann Rodrigues, 2019). The coping strategies for flooding are either structural or nonstructural, reactive (done after flooding) or potentially preventive/pre-emptive (done before, in anticipation, of flooding). Since they result from self-efforts, Udelsmann Rodrigues (2019) framed them as do-it-yourself. Within informal contexts, nonstructural measures were minimal compared with structural measures. Nonstructural measures identified include weather monitoring by residents, community education and awareness and engagement with municipal authorities for infrastructure provision.

Common examples of structural measures identified within low-income communities across cities in Sub-Sahara Africa include erecting barriers at doorsteps/entrances, desilting or clearing available drains, creating water outlets in buildings, removing water from houses (using buckets and pumps), placing properties on higher places (tables, beds, wardrobes, etc.), raising foundation and re-roofing reaped roofs. Some structural measures are not so popular. In Lagos, Ajibade and McBean (2014) observe that residents transport flood victims through canoe, while Amoako (2018) notes that communities organize post-flooding disinfection to reduce disease spread. Residents move up to hide in the roof or upper parts of building till flood subsides in Luanda (Udelsmann Rodrigues, 2019). Literature indicates that tenancy, gender, household size, lived experience of flooding, place attachment, house location and type among other factors influence the kinds of structural coping strategies deployed within low-income communities (Amoako, 2018; Twum and Abubakari, 2019; Amoako *et al.*, 2021).

The different studies directly and indirectly show that some of the coping initiatives have succeeded, some are not suitable while some failed, even suggesting maladaptation within the low-income urban contexts. Success or failure of coping and adaptation practices by households are largely influenced by information, technologies and resources available as well as quality of social capital – which together reflect adaptive capacity (Dolan and Walker, 2006; Cobbinah and Kosoe, 2019). The absence of institutional or ample external support to harness local level coping initiatives and adaptive capacity is also a factor (Leal Filho *et al.*, 2018). These situations highlight the need to better understand responses to flooding and other environmental challenges to provide catalytic support for co-production of adaptation and risk reduction within low-income urban environments (Satterthwaite *et al.*, 2018).

Study area

Lagos, Nigeria's commercial capital and a coastal city containing about 20 million people, is the context in this study. The city experiences frequent, intense rainfall, which often lead to coastal flooding. With predictions of SLR accompanying climate change, coastal flooding is bound to continue in Lagos. This is the reason why Lagos was ranked 15th, globally, for exposed population to flooding based on 2070 climate scenario projections (Nicholls *et al.*, 2007).

Continual flooding in Lagos poses serious risks to lives, livelihoods and built environment of around six million people, most of whom reside in slums along the coastline (Pelling *et al.*, 2018).

The settlement known as Idi-Araba in Oworonshoki area of Lagos is one of the coastal slum communities (see Figure 1). Its emergence can be traced to the early 1980s, starting as a fishing settlement. It was named after a tree where the fishermen met to socialize and relax (Olorunwa, 2014). According to a Lagos State Government's assessment in 2015, the settlement contains 188 houses and 516 households. It consists mostly young people – 88% who are aged 21–40; 91% are married; 67% are self-employed in the informal sector, while 67% have a least junior secondary education. Households 1 to 4 and 5 to 9 persons constitute 59% and 39%, respectively (Lagos State Government, 2015). An enumeration conducted in 2019 shows that the settlement contains around 2,456 persons within 709 households. Males represent 50.91% of the population, and mean household size is 3.46 (Lagos Urban Studies Group, 2019). These statistics, especially that of households, show that the settlement's population is growing. The residents are majorly of the Ilaje ethnic extraction, who work as fishermen and originate from the coastal areas of Ondo State, Nigeria. Other ethnic groups from Nigeria as well as international migrants from Togo, Benin, Niger and Ghana live in the area.

Research methods

A mixed-method approach was used for this study. It involved three sequential activities. First is the collection of qualitative data through semi-structured interviews, followed by a survey to collect quantitative data and finally a town hall meeting to engage the residents. In all, 15 purposively selected residents were interviewed to elicit information that address the study's objective on coping strategies. All the interviewees were adults who had lived in the community for a minimum of 12 years, fulfilling the purposive sampling criteria initially set. So, they could confidently comment on climatic issues based on experience. The selected residents were questioned about their experience on flooding impacts and details in terms of personal, household and communal measures adopted to cope with different flooding occurrences. They were also asked to suggest pathways to better cope with and ultimately adapt to flooding. Most of the interviews were conducted in the Yoruba vernacular language for easy understanding. The recorded interviews were later transcribed and translated before coding and content analysis took place.

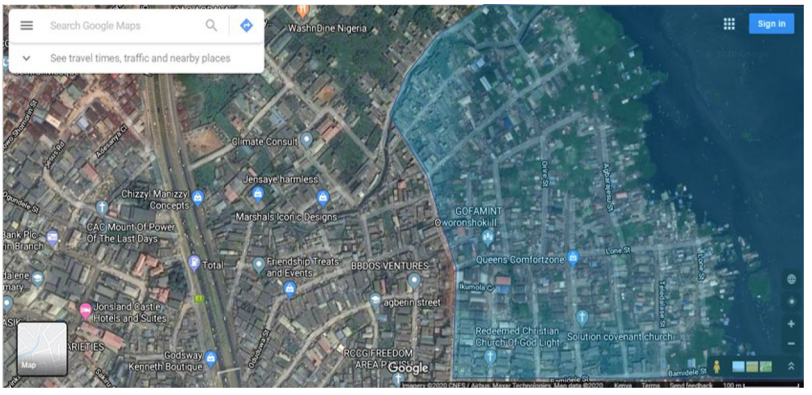

Figure 1.
Satellite image showing Idi-Araba community (highlighted), Oworonshoki, Lagos

A survey followed up the semi-structured interviews. Issues emanating from the interviews and from literature review informed design of a survey tool – the questionnaire. Using the sample size determination method recommended by Krejcie and Morgan (1970), a sample size of 333 was derived from the 2,456 estimated settlement population. This was scaled down to 300, given time and resource constraints available for the study. Five trained residents assisted with questionnaire administration. They completed the questionnaire by interviewing each sampled resident (the respondent) or dropped it (and returned to retrieve) for respondents who want to complete it themselves. Of the 300 questionnaires produced and given out, 270 were retrieved. Upon screening, only 248 were used for analysis and presented in this article.

To disseminate preliminary findings emanating from data collected through the mix of methods, gather feedback and elicit further information related to the study, a town hall meeting was held within the community. The Baale (local community chief) accepted to host and convened the meeting on a Sunday evening – a time when most residents will be available within the community. Over 100 residents participated in the 90+ min event which was held at the space serving as community hall (see Figure 2) in the settlement.

Results

Residents and settlement's characteristics

The socioeconomic characteristics of respondents are shown in Table 1. Of the 247 respondents, 52.8% were male, 46.8% were female. Highest percentage (27.8%) is between 35 and 44 years, followed by 22.2% in 25–34 age group. Most (at 48.8%) are self-employed. Majority are formally educated, as only 13.7% had no form of formal education. The highest proportion (45.2%) had monthly household income below N30,000 (US$79), which is lower than the national minimum wage or the global $2 per person daily international poverty line. It is notable that a few households within the settlement earned over N250,000 (US$1,319) per month.

Information about housing characteristics is presented in Table 2. The highest percentage of the respondents is landlords/homeowners (38.8%), followed by renters at 37.6%. Almost half (43.7%) of the renters pay between ₦5,001 (US$13) and ₦15,000 (US$40) rent monthly. About one-third (34%) of the respondents get water from pipe-borne municipal sources, usually by paying a small amount at communal tap points. Another 32.4% rely on community or private borehole, which are at times free to fetch but with lower quality compared with that which is municipally supplied. In terms of sanitation, the majority use the water closet, either located within (32.2%) or outside the house (45.9%). The houses are majorly (60%) walled with hollow sandcrete blocks. Based on the respondents' assessment, 54.7% believe their buildings only need minor repairs, 18.7% think they are okay, while to some 1.6% they are not habitable.

Figure 2.
Town hall meeting in Idi-Araba community, Lagos, February 2020

Attribute	Characteristics	$N = 247$	(%)
Gender	Male	131	52.8
	Female	116	46.8
Age	18–24	21	8.5
	25–34	55	22.2
	35–44	69	27.8
	45–60	62	25.0
	Above 60	31	12.5
Formal education	None	34	13.7
	Primary	79	31.9
	Secondary	69	27.8
	Tertiary	40	16.1
Household size	1	30	12.1
	2–4	69	27.8
	5–8	75	30.2
	Over 8	64	25.8
Employment status	Self-employed	121	48.8
	Employed	82	33.1
	Not employed at all	17	6.9
	Retired	12	4.8
Monthly household income	Below #30,000 (US$79)	112	45.2
	#31,000 – 75,000 (US$198)	79	31.9
	#76,000 – 150,000 (US$396)	12	4.8
	# 151,000 – 250,000 (US$660)	8	3.2
	# 251,000 – 500,000 (US$1319)	3	1.2

Table 1. Socioeconomic characteristics of the respondents

Flooding and sea level rise impacts

The situation in Idi-Araba settlement is typical of informal low-income housing development which occurred outside purview of the state. This informal mode involves decimation of natural ecosystems, which overlapping with climate change (extreme weather events and SLR), result in flooding. Flooding is a common experience in the settlement, as its impacts are apparent. It affects houses, mobility (roads), livelihoods, health and so on. A female resident's explanation is that:

> [. . .] since this area is below sea level, we are always disturbed by rainfall whereby we have flood especially when it is rainy season. We don't enjoy walking about. We must put on boot [covered footwear][. . .] Whenever it rains, we experience a lot of flood that disturbs many of our activities. Even to our houses, we discover that after some time, the house begins to sink. With that many structures are destroyed (Interview 15, September 2020).

The survey ascertained, from the respondents, whether their houses have been affected by flooding and SLR. 43.6% of the respondents indicated that their dwelling has suffered different levels of damages. The general trend is that "buildings normally sink, some collapse, some go down, because of water that comes around. Water doesn't go, it will just occupy the whole place for about almost 3–4 months before it finally dries" (Interview 3, November 2019). This happened every year but is also linked to "the rain that falls every three years affects us. It has been like that since I got to this place [24 years ago]. It comes in large quantity every three years – covering everywhere and entering houses" (Interview 12, December 2019). Figure 3 shows sinking buildings in the settlement. The buildings are not durable – materials used appear substandard, and the construction is poor in quality. This might be linked to weak socioeconomic conditions in the settlement, and with the changing climate, the pattern of impacts is becoming rampant.

Characteristics	Description	(%) (n = 247)
Tenure status	Owned/Landlord	38.8
	Rented	37.6
	Family house	23.2
	Others	0.4
Monthly rent	Less than ₦5,000	28.1
	₦5,001–15,000	43.7
	₦15,001–25,000	23.7
	₦25,001–50,000	3.0
	Over ₦50,000	1.5
Source of water	Municipal pipe-borne water	34.0
	Community/private borehole	32.4
	Well	5.8
	Tanker delivery	2.9
	River/Ocean	5.0
	Sachet/Bottled water	19.9
Sanitation	W/C within the house	32.2
	W/C outside the house	45.9
	Community toilet	5.2
	Pit latrine	10.3
	Open defection	6.4
Building's external walls material	Raffia palm	2.1
	Mud	6.2
	Sandcrete block	60.1
	Iron sheets	0.4
	Timber/planks	13.6
	Tarpaulin	2.9
	Burnt bricks	1.6
	Concrete	12.3
	EPS	0.8
Building's condition	Okay	18.7
	Needs major repairs	25.2
	Needs minor repairs	54.5
	Too bad – not habitable	1.6

Table 2.
Housing characteristics of the respondents

Building-related responses

The survey shows actions taken by the residents when their houses are flooded (see Figure 4). Some (40.8%) remained in the affected building, while almost half (43.3%) who might also remain, repair the affected part especially when the damages are not major. Notably, only 4.4% of the respondents relocated permanently from the damaged building. Some tenants are forced to relocate permanently when the damage is much. Some (11.6%) relocate temporarily for flood to subside before returning to their property. The decision to move or remain would be influenced by a couple of factors including socioeconomic ones. For example, self-employed persons whose livelihoods are home-based will not attempt relocation but prefer to remain, fix and/or fortify the impacted dwellings.

Furthermore, a range of structural strategies are made in response to or expectation of flooding (see Table 3). The most reported measure (17.9%) is placing valuable goods and furniture on a higher level, to keep them away from floodwater and prevent or at best minimize damages. Some (5.1%) used weather-resistant (waterproof) materials to cover their building before the rainy season, while 11.2% create pathway for water around them. Efforts are also made to drain stagnant water from the building by 8.7% of the respondents. Raising the ground floor level for new and existing buildings is practiced by 8.9% of the

Figure 3.
Sunken and deserted buildings in Idi-Araba settlement

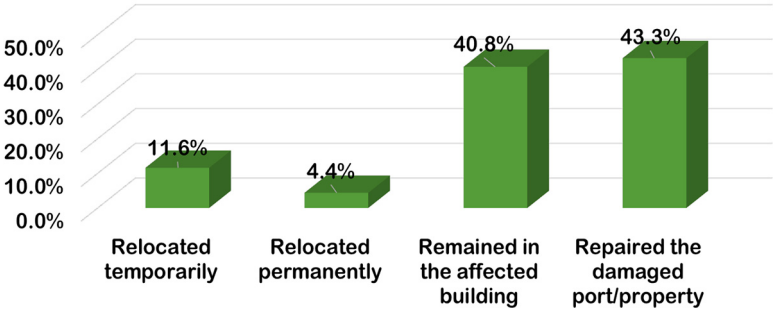

Figure 4
Action when flooding affected their building

respondents (see Figure 5). Higher floors and building plinth especially at the entrances prevents runoff ingress into the building. These strategies would be informed by availability of financial resources to, for example, acquire weather-resistant materials or construct a higher ground floor. Strategies such as placing goods on a higher level may not need any money to execute.

Respondents (11.3%) also sand-filled their surroundings to keep away water from reaching and entering the building. Within some houses and on a few streets, waste materials were dumped on the road to fill it and create a higher level that prevents flooding (see Figure 6). Desilted materials from outside the settlement is dumped to fill up a major street (see Figure 6). The community leaders are discouraging this kind of action, which must have been done ignorantly, because waste further litters the neighborhood. It should be repurposed rather than used to fill the road and doing this makes the soil more difficult to remediate in future (personal communication, Town hall meeting, February 2020).

Structural measure	(%)
Place valuable goods/furniture on a higher level	17.9
Raise ground floor level of the building	8.9
Raise the height of the house's platform (or stilts)	5.3
Erect a barrier/embarkment	3.4
Construct drainage (culvert/gutter)	7.4
Clear/de-silt drainage	4.9
Drain stagnant water	8.7
Create a pathway for water around the house	11.2
Sand-fill surrounding of the house	11.3
Construct wooden bridge	3.7
Cover building with water-proof materials	5.1
Create outlet on houses for easy outflow of water	6.8
Plant trees/grasses/shrubs	0.3
Cut down vegetation	1.9
Other measures	0.2

Table 3.
Structural measures against flooding

Figure 5.
(Re)shaping existing building (left); higher floor for a new building (right)

Through the interview questions dealing with structural flood control strategies, the residents elaborated on measures adopted. Most of these are directly related to the building and its immediate environment. In anticipation of the rainy season and flooding cycle, people "check their house for whatever needs to be repaired before the breeze comes. Anywhere the wind can pass will be blocked. Sometimes, it may be a little opening through which the wind will penetrate to remove the house" (Interview 12, December 2019). The principle is that "when you notice there is a leakage in the roof and the raining season is approaching, you just have to repair the roof" (Interview 9, December 2019). Roofs are at times constructed with a short king post so that the overall roof height is low to reduce interference with the winds (Interview 13, February 2020).

Local understanding of weather and climate system is deployed in assessing flooding levels and preparing for subsequent occurrences within the community. This at times involves marking floodwater levels on buildings annually as explained by a resident who is active with the community association. "This year we marked where water reached. When the water flows in yesterday, it was very much. We have marked where it reached[. . .] We even had to mark where it entered the road. So, we know this year was more than last year", she explained (Interview 1, November 2019). Significant level of formal education among the residents might have influenced the efforts to track annual floodwater levels.

The knowledge that flooding will occur informs some preparations. Since it is "known that this area is prone to flood [. . .]. So, everyone went to prepare. Those whose building was low had to increase and develop it" (Interview 8, December 2019). For those who remain in the

Figure 6.
Waste (top) and desilted material (below) dumped on streets in Idi-Araba

building, people raise a platform in the room and put their materials on it until the water would go. Those who have money will raise the floor level based on the experience from previous years (Interview 13, February 2020). "All of us know the water level. So, we fill it [the building] higher than the water level. Don't let your ground floor be two block coaches [450mm] above natural ground level but up to 4 or 5 coaches [900mm]," another resident remarked (Interview 4, November 2019). Structural measures in the external part of the building include placing blocks as steppingstones or filling up with sand in expectation of water inundation. Homeowners within the community often lead these endeavors for their own compounds. Someone noted that in "my place now you will step on blocks before you enter my room. I prefer it like that until I have enough money to buy sand and broken blocks to fill it" (Interview 10, December 2019) while another reported that "water entered her compound, but we rose to control it with sand and other things to hinder it from entering the building" (Interview 8, December 2019).

Local knowledge of the climate and flooding patterns is not enough. With weak socioeconomic conditions, this knowledge still results in lack of adaptation. Flood proofing should be backed up by funds, which the socioeconomically weak households often lack. To avert problems, "some people pack out of the house when they can't raise their building, and they know it will be affected, [. . .] because they don't have money to raise their building or fill it" (Interview 8, December 2019).

Attempting green infrastructure

As the survey shows (see Table 3), only a very minute proportion (0.3%) of the respondents planted trees, grasses or shrubs around their property for stormwater management or flood prevention. More respondents (1.9%) cut down vegetation, than develop it to deal with floods. While this shows missed opportunity for green infrastructure approach, knowledge on the potential of nature-based solutions in addressing flooding is present with some residents. A male resident "believe the first thing is to go back to the olden days. Though it's not easy now [. . .]I believe trees do many things. But now we don't have something like that. I told you that when I came here most places were groovy [mangrove] areas[. . .]if they had allowed nature to take its course, maybe[. . .]" it would have reduced the flooding (Interview 10, December 2019).

Developing vegetation for stormwater management at the site scale are hindered through different factors. Soil conditions in the community are not in themselves conducive to normal vegetation growth. The experience is that "at times when we plant trees, because there was a time that I tried to plant trees, but when the flood came, it was killed by the salty water[. . .] I planted corn and vegetables, but when the flood came. it was all destroyed" (Interview 2, 1 November 2019). Regarding the soil, someone explained that "I would have suggested we should do tree-planting but the soil here is not good at all. If we have been planting trees with vegetation,[. . .] we won't be falling sick the way we fall sick now, you understand" (Interview 3, 1 November 2019).

Nonstructural measures

The nonstructural measures in response to flooding are presented in Table 4. Some of the respondents (16.5%) obtain information on the weather forecast to be abreast of the season, timing, intensity and gravity of rainfall and probability of flooding. This enables preparations before flooding. Some respondents (2.5%) store goods (e. g. water and food) and valuables safely before rainfall occurrence. Others sought assistance from family and friends (2.5%), joined self-help group/saving scheme for possible access to finance (2.1%) and joined a social/religious organization for support when the need arises (0.8%).

Some dressing and dietary measures are also deployed. A resident explains that "there is cloth we wear from June downwards. There is food that we eat at each season. The food we eat during the raining season must be peppery, to keep you warm internally - that's what our fathers believed" (Interview 14, March 2020). In terms of dressing, "you have to use your rain boot to prevent water from eating up [infecting] the leg. If you dip your leg so much in the floodwater, it will attract sicknesses" (Interview 8, December 2019). A therapeutic measure explained is that "when someone has put his leg in flood water for a long time, you are expected to dip your leg into salty warm water to kill the germs the legs are infected with" (Interview 8, December 2019). These strategies require little or no cost, hence they are suited to weak socioeconomic conditions of the households. They provide basis for behavioral initiatives that complement structural measures to flood adaptation.

Self-help approach

The responses to flooding have principally emanated from individual self-help and community efforts, also a reflection of the socio-economic conditions. Finance for post-flooding repairs and flood-prevention fortification is mainly sourced from personal or household income. Representing 58.7% of the respondents, 145 persons confirmed this, reinforcing the self-help principle. Others raise funds through a range of sources, mostly from individuals and groups within the community and some from outside the community

Table 4. Nonstructural flood coping measures

Non-structural measures against SLR/flooding	(%)
Obtain information following weather forecast	16.5
Store goods safely beforehand	2.5
Join self-help group/saving scheme	2.1
Join a social/religious organization	0.8
Seek assistance from family	2.5
Seek assistance from social/religious group	0.4
Develop evacuation mode	0.4
Move to safer ground	0.4

(see Table 5). The highest number of residents raise money through loans from cooperative societies. Only a small proportion raise finance from governmental sources.

Effectively adapting to flooding through self-help is capital intensive. A lot of funds are needed which many residents do not have. A female resident acknowledged that "we always experience flood - water disturbing everywhere. That has been the experience over the years. It is only when one is financially okay that he can get over it because its management entails a lot of money. That is what we have been doing but it is not easy at all" (Interview 15, September 2020).

Social capital within the settlement supports the local initiatives and community-based approach. The community spirit is that "if you have any problem and you go to another person, they will help you. We help ourselves if there is anything, we rally round ourselves [. . .] we are trying now to task ourselves if we can fill it and make gutters" (Interview 2, November 2019). The support goes beyond money. In-kind supports are offered to households whose dwellings are flooded. Figure 7 captures the range of support received and number of respondents who reported this.

The prevailing mindset explained by a resident is that "we don't have to wait till the government will help us. Heaven helps those who help themselves. We survive here with our efforts, and we're becoming used to it as we age" (Interview 4, November 2019). This

Source	No	(%)
Federal govt	6	4.4
State govt	12	8.8
Local govt	1	0.7
Private company	3	2.2
Community group(s)	6	4.4
Bank loan	16	11.8
Cooperative society	44	32.4
NGO	6	4.4
Churches	4	2.9
Individuals within the community	24	17.6
Individuals outside the community	14	10.3
Total	136	100.0

Table 5.
Other sources from which finance are sourced

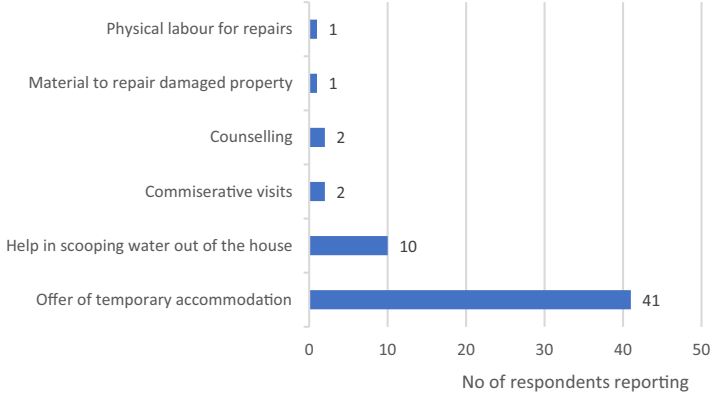

Figure 7.
Range of in-kind support received from within the community

widespread thinking is the basis for self-help and communitarian approach in the coping mechanisms. It fuels iterations of the initiatives in a situation where households' socioeconomic resources are limited and the state in significantly absent. This noteworthily holds some hope for adaptation pathways to flooding.

Discussion

The range of coping strategies identified in Idi-Araba informal settlement is not significantly different from those earlier reported in literature. They fall into the broad categories – either structural or nonstructural, either anticipatory or reactive. The different coping measures indicate two main directions. Some are effective relatively – at least with individuals and at the household level – while other are not, highlighting deficits that adaptation need to address.

Some measures done over time are clearly not effective, not suitable and not sustainable. For example, filling up space with waste or desilted materials deepens vulnerability to flooding and SLR. They make future interventions more difficult. These ultimately constitute maladaptation. Schaer (2015) identified a similar situation in Senegal. She explains that with very limited resources, poor urban dwellers in Dakar "respond to perennial flooding with very diverse strategies [. . .] [but the] local coping and adaptation strategies are mainly maladaptive because they divert risks and impacts in time and space and have detrimental effects" (Schaer, 2015, p. 534).

Additionally, these self-help and community-based approaches are limited in terms of effectiveness and alignment with existing regulations. This kind of mismatch must have informed the Lagos State Government's description of a neighborhood's efforts to clear and improve on their drainage system "as exercise in futility, self-serving and cosmetics," because it disregards the city's drainage masterplan (Lagos State Ministry of Environment and Water Resources, 2019). The state government is however not taking adequate responsibilities on structural and nonstructural flood risk management such that community-based, self-help initiatives become unnecessary.

There is clearly a need to move away from maladaptation and weak adaptive capacity to transformational adaptation in this case community. When historic coping strategies in systems (such as an informal settlement) are ineffective and insufficient to address current and projected climate challenges, transformational adaptation becomes an imperative (Revi *et al.*, 2014; Parry, 2017). In case of this coastal informal settlement in Lagos, achieving transformative adaptation will need to address and harness the following areas:

- buildings

  Dwellings within the settlement need to be upgraded, first, to improve their quality (structural stability, durability, etc.). The upgrading must incorporate flood adaptation, not merely flood defense initiatives as currently unsuccessfully practiced by many households. New houses implementing a higher ground floor level and marking water levels on buildings annually are existing initiatives in these directions within the settlement. They can be harnessed and upscaled to make buildings floodable.
- infrastructure and services

  Provision of the hitherto absent basic infrastructure and services, especially roads, drainage, waste management, grid-connected sanitation and so on are critical not just to flood control but adaptation. These will take pressure off the decimated bio-physical systems, unduly making up for absence of water-related infrastructure. A

water-sensitive, sustainable approach, for example, use of permeable paving for roads, should be adopted.

- natural ecosystems

  With relevant services and infrastructure in place, restoration of the degraded coastal bio-physical systems (for example, through mangrove ecosystem restoration) can be pursued, aligning with nature-based solutions approach for climate adaptation.

- social capital

  Social capital within the community is notable in terms of their post-disaster contributions. Sathethwaite (2018) support these for climate adaptation because of their potentials. In the Idi-Araba case, harnessing such can even extend to aspects of local savings group, enumerations, etc. Existing aspects of social capital and the community's organizational character can be tapped for improvement in cognitive, social and political domains. These are crucial to upscaling adaptive capacity.

- community organization and collaboration

  The desired transformation cannot be achieved alone by the local community. Ultimately, it demands appropriate collaboration, investment and communication among individuals within the settlement, local-level actors [including non-governmental organisations (NGOs)] and state agencies.

Conclusion

The challenge of flooding and rising sea level within coastal slums is well embodied in the case of Idi-Araba community in Lagos, Nigeria. The study reported in this article has provided a brief view of the flooding impacts, the structural and nonstructural coping initiatives within the low-income area. It has shown attempts to use green infrastructure for flood control and shed light on the inherently self-help approach behind the individual, community-based initiatives.

This study deals with a single case. Notwithstanding, it contributes to knowledge by providing additional evidence of coping strategies within coastal informal urban settlements. The work shows a few plausible measures and limitations of most – revealing adaptation gaps within the local-level initiatives. These gaps highlight areas of opportunities, which in turn provide insights about where interventions are needed to improve adaptive capacity. For example, the hubs of social capital (e.g. churches, cooperative groups) offer a platform for mobilization, catalytic funding, etc., for flood adaptation. The interventions will no doubt demand collaborative, productive action between the residents (community), the state and the third sector.

It will be relevant for future studies to zoom into each of the aspects where adaptation is lacking. For example, what are the design alternatives and cost implications for property-level flood adaptation measures. It will also be useful to investigate factors that can help to enhance plausible flood adaptation behavior among the residents. A longitude research design capturing change in the different aspects over a given time will also be worthwhile.

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