On Land Development Practice and Urban Environmental Degradation: The Example of BDPA Estate in Benin City

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Abstract
Sustainable and resilient urban environments are created by fitting environmental practices. One important area of practice is land development where the guidance of regulatory authorities and the compliance of developers together work to shape the built environment. Where this partnership does not exist or is not effective, inappropriate land development practices may result, with the potential to generate environmental degradation, particularly where there is a high intensity of land use. Thus, this paper investigates how the built environment may be impacted by land development and management practices. The issue is examined in the context of Benin City's BDPA highly populated residential estate where signs of physical environmental degradation are becoming evident. The research approach involves physical inspections and secondary data review. The features of land development practice in the estate are ascertained; evidence gathered on their impact upon the physical environment and responsibility for these deficits established between individual developers and the regulatory authority. The findings reveal that acts of commission and omission at the official and developer levels contribute to physical environmental degradation. Official regulation and enforcement are weak; and awareness of planning regulations low amongst private developers. The outcome has been non-compliant and environmentally-unfriendly development. Again, government, has been negligent by not building sustainable paved roads and drainage channels. The conclusion is that a strong nexus exists between land development practices and physical environmental degradation in the study area. It is recommended that further physical degradation be arrested by rectification of the identified deficiencies and the institution of safeguards.

Key Words: *Benin City; Environmental degradation; Land development; Urban planning; Urban sustainability and resilience*

1.0 Introduction

The view is widely held that cities are ecosystems which are comparable to the ecosystems of Mother Nature. According to Moyers (2021), *"An urban ecosystem is simply the community of plants, animals, and humans that inhabit the urban environment. It is an area physically dominated by built structures like buildings, roads, sewers, and power lines"*. The suggestion is that the urban ecosystem is human-created as distinct from natural ecosystems, the city being a built environment which is created from the natural. The natural ecosystem usually has to be either disturbed or destroyed by human actions in order to create the urban ecosystem. The removal of natural vegetation through bush clearing, bush burning or deforestation can be a harbinger of negative changes depending on how the cleared land is managed. In arid regions, desertification and land degradation are associated with a loss of the natural vegetation. Similarly, in the rain forest region, depletion of forest cover and poor soil management tend to be harbingers of changes which have the potential to degrade the environment. These include the onset and accentuation of flooding events and erosion, elements associated with climate change which has also been a factor in physical environmental degradation in the urban areas of Nigeria. An example is Udoimuk *et al*'s., (2014) study of rainfall effects on Calabar which reveals that climate change has produced alterations in vegetation belt patterns and *"enhanced wind erosion, desertification, soil erosion and coastal flooding"* in the city(Udoimuk *et al*.,.2014:p.7).

A disruption of the natural environmental order creates systemic imbalances, If not well managed, the prospects of producing deleterious consequences are heightened. In some cases, these consequences may become difficult or impossible to overcome. The potential of climate change to heighten these challenges makes essential the adoption of practices which can promote environmental sustainability and resilience. Ideally, this should be integral to the land development process. This requires the recognition of the impact of anthropogenic activity on natural environment. These include the fact that removal of natural vegetation leads to the loss of protective canopies formed by trees; loose soils may result from removal of the hard pan by excavation activity which may lead to erosion; the loss of greenery on hills and slopes may predispose such areas to gully erosion and even landslides. Since all of these changes have the potential to create unsalutary consequences, it is imperative that land development should be sustainably conceived, planned and executed. This calls for environmentally responsible development which seeks to protect nature and ensure that its workings are not entirely lost in the desired and newly created environment. Achieving this requires a recognition of the role of landscape and the natural environment in urban environmental sustainability and resilience. Such an approach would conform to the widely held view that cities are *"ecosystems of people, nature and infrastructure"* (Urbanoikos, 2016).

In essence, land development is driven by the usefulness of land to humankind. These many uses rationalise the continuing desire to make the most out of land and optimise its value. This aim is actualised through land development, the *"process of advancing the usefulness of land"* as asserted by Fraser (1993, p.237). The process, Fraser (1993) further explains, may include *"building on*

land for the first time (new development), the replacement of existing buildings by new structures (redevelopment), or even through substantial conversion, alteration and modernisation of existing buildings" (Fraser, 1984, ibid).

In every ordered urban system, the development of land is subject to official regulations. This responsibility makes the regulatory authority a partner with the developer of property in every instance, even where government projects are involved. In public sector projects, government is the developer whilst the regulatory agency stands as a partner in the arrangement for the purpose of protecting the interest of society. Private developers consist of individuals, groups, corporate organisations and institutions who undertake land development. These groups are usually more active than government in land development. Since government has a duty to enforce development laws through regulation, it tends to show a good example by ensuring full regulatory compliance in all its physical development. Thus, the challenge of non-compliant land development tends to occur mainly in private sector development. The intent of the physical planning and building regulations is to produce development which meets the set standards in terms of constructional and environmental quality. This requires legal empowerment of the planning authority to restrain, constrain and coerce into compliance (Roberts, 1999), land developers who neglect, fail or refuse to act in accordance with laws designed to protect the wider interest of society. The guidance of regulatory authorities and the compliance of developers work together to shape the built environment. Where this partnership does not exist or is not effective, inappropriate land development practices may result, with the potential to generate environmental degradation, particularly where there is a high intensity of land use as in urban areas zoned for mixed land use.

Land development practice encompass all the actions, both official and unofficial, taken in the process of converting land from its natural state to an improved state; or converting an existing use to a more modern and intensive use which increases its utility and value. Actions taken in the process include the removal of the natural vegetation; excavation of the soil; building activity such as fencing, foundation or structural work, erection of the superstructure, roofing, creation of drainage channels; planting of greenery and concreting or paving the compound space. As mentioned, land development also involves increasing the intensity of use. This occurs where land is redeveloped or substantially refurbished. In order of initiation, a typical commercial or residential development scheme, for example, consists of these stages: site identification, planning and processing, arrangement of finance, construction, and finally, letting or disposal (Fraser, 1993). The law requires that all development be compliant by meeting with physical planning requirements, specifications, standards in design and execution. Non-compliance occurs where development lacks official approval or falls short of the approved standards. These include the violation of setbacks and plot ratios. Non-compliance also includes unapproved use conversions of previously approved development.

1.1 Scope of the Study

The urban environment has physical and non-physical dimensions. Thus, environmental degradation may come about in any of these two ways. The focus of this study is on degradation in the physical dimension only. This is in regard to the implementation of physical development. Specifically, this relates to infrastructural provision as in paved roads and an effective drainage

system which can serve to extend the lifespan of the former. In addition, it concerns building designs which take cognisance of the implications of rainstorms, rainfall and storm water for sustainability and resilience of the built environment, appropriate plot development ratios and setbacks. Lastly, it considers role of greening, particularly in an environment which has become increasingly prone to flooding events.

After this introduction, there follows a literature review and an explanation of the methodology. Then follow the results. The discussion commences thereafter. Practical implications are identified before presenting the conclusion.

2.0 Environment, Development and Degradation

Governance is a crucial factor in the quality of urban environments. This suggests that the quality of an urban environment is a reflection of the choices and preferences of those who occupy and use it. Ideally, these choices should be jointly made by the various stakeholders in the environment because the state of the environment affects all who inhabit it. Thus, unilaterally made decisions will tend not only to be sub-optimal, but also, difficult to sustain due to the absence of a 'buy-in' amongst stakeholders. Environmental decisions are made at national, regional and local levels. Amongst these are national environmental protection policies, regional plans and urban development policies and standards. The modern practice is that urban environments are planned either from scratch or by the adaptation of an existing unplanned form to reflect modern principles. This defines urban planning as a tool which is readily applied to create, manage and sustain the physical environment of towns and cities. The quality of the environment so created greatly determines urban liveability which summarises a city's qualities for successful living, working and recreation.

The environment consists of the atmosphere, the biosphere and the stratosphere. In its natural state, it is usually a stable system because the ecosystem is usually undisturbed except by natural forces. However, human activities tend to produce a negative impact on the environment (UN, 2015).The difficulties so created have the potential to impact present and future occupiers and users of the environment (Massachusetts Institute of Technology, 2000). The phenomenon of environmental degradation tends to impact the atmosphere, biosphere and hydrosphere. According to GMET (2009), "*Environmental degradation is a process through which the natural environment is compromised in some way, reducing biological diversity and the general health of the environment. This process can be entirely natural in origin, or it can be accelerated or caused by human activities. Many international organizations recognize environmental degradation as one of the major threats facing the planet"*. In the case of agricultural land, the phenomenon of degradation occurs where there is a reduction or loss of the biological and economic productivity and complexity of land. The process involves water erosion, wind erosion, sedimentation by these agents, long-term destruction of vegetation, and diminution of animal and plant populations, and decreases in crop yields. Urban environments are prone to environmental degradation. These take the shape of floods, erosion, pollutants and sanitation. An increase in the number of people who occupy an environment puts a stress on infrastructure and facilities as does the poverty rate through crowding and the growth of informal settlements and slums. The common link is urbanisation or

an increase in the relative numbers of a country's population who live in cities where facilities are inadequate as tends to be the situation in Africa (Arimah, 2001).

Urban physical environments are built spaces. Built spaces are planned spaces because planning (inclusive of design) is preceded and guided by rules and precepts. The presence and effectiveness of urban planning is perceivable from the state of the built environment. Correspondingly, the absence or ineffectiveness of planning governance is discernible from the physical environment of cities. Being "*environmentally responsible"* is considered by the New Zealand Urban Design Protocol (2005) as one of the attributes of successful towns and cities. To be environmentally responsible, a city should "*recognise the role that landscape and the natural environment play in making their urban areas great places to live and work, and they value the contribution they make to their identity, liveability and quality of life"*. A liveable urban environment is a sustainable environment devoid of the elements of degradation whether of the physical or non-physical type. This ensures a quality of life which enhances good health and contributes to longevity. According to Steiner (2009), *"A modern city can only be truly successful if it can convincingly demonstrate its green credentials by recognizing its natural assets, creating efficient water, energy and transport infrastructure, and protecting its citizens in the face of present and future impacts of climate change".*

As mentioned, most land development is undertaken by private interests. There is a difference in orientation between private land developers and the planning authority. The former are profit-seekers whilst the latter are standard-setters and standard-enforcers acting in the interests of society (Roberts, 1999). Regardless of these differences, responsibility for producing compliant development is shared by both parties. The developer is obliged to obey the law whilst the regulator is empowered by law also to guide the former, compel obedience and apply sanctions when necessary. Thus, an environment in which non-compliant developments predominate is indicative of failure in the discharge of this shared responsibility.

Urban development which is non-compliant has the potential to cause or promote degradation in the environment. This may be physical or atmospheric. Physical degradation may occur through landscape erosion and flooding events. These may be due to an absence or inadequacy of storm water drainage or an intensification of runoff by construction practices which prevent infiltration of rain water. Also, decayed or senescent infrastructure is indicative of degradation of the built environment. There may also be pollution of the air and airwaves. Degradation occurs mainly through anthropogenic activities which create environmental stresses and thereby threaten the capacity of the environment to sustain human activities (UN, 2015). Environmental sustainability and resilience are threatened by environmental degradation, whatever the source. This makes imperative the proactive protection of the environment by its occupants.

These evaluations reveals as follows. First, the urban physical environment is shaped by those who occupy and use it. Second, the quality of the built environment is dependent on the quality of development practices and the management efforts which are subsequently employed. Third, physical degradation is always a threat to the sustainability of urban environments. Fourth, urban

planning, as a tool of urban management, impacts the quality of the built environment by its powers of design, standardisation, regulation and enforcement. It is, therefore rare, if not impossible, to have a low quality built environment where the planning function is fully effective. Fifth, there is a relationship between planning and sustainable physical environments. Therefore, where an urban environment is not sustainable, there is the likelihood that planning is not functionally effective.

As mentioned, land development has the potential to impact the urban environment in a manner which can lead to its deterioration. This study seeks to investigate the evident signs of physical environmental degradation in Benin City's government-built BDPA residential estate which has over the years developed into a mixed use area accommodating many commercial activities and an accompanying high density of population and vehicular traffic. It examines the features of land development and management practices in the area by developers as well as the regulatory authority. This is done to ascertain the impact of these practices in the study area with a view to highlighting issues which need to be addressed in order to achieve better standards which can assure environmental sustainability and resilience. In order to achieve this aim, the study will:

(i) Examine the physical environment in the study area for evidence of degradation;
(ii)Ascertain land development standards and practices in the study area; and
(iii)Establish reasons and responsibility for observed evidence of physical environmental degradation in the study area.

3.0 Approach

This is a case study of an estate originally developed by the public sector, but where private interests have over time undertaken further development through re-developments, major alterations, modernisations, and particularly, use conversions from residential to non-residential. Although land development practices constitute actions taken to improve land to achieve a profitable outcome, the development process is not examined here. Rather, the outcome is the subject of examination. This means that existing development (the entire built environment) in the study area is the outcome of actions already taken, both positive and negative, in the land development process. Since physical environmental changes constitute the subject of investigation, a field approach was thought to be most appropriate. Therefore, the research approach of the study involves inspections and observation for the purpose of collating data on the state of the physical environment. The focus was on the roads, drains, fences, constructional styles of dwellings (structures) and compounds. A checklist, as shown in Table 1, was used for this purpose. Observed defects were noted. Their causes were identified and classified. The physical state of the study area was established from which was ascertained the nature of land development practices. This formed the basis of evaluations and inferences relevant to the study aim of ascertaining the impact of land development practices on the physical quality of the built environment. These formed the basis of the discussion and the identified implications.

Table 1: Checklist for Physical Inspections

Infrastructure	Building Designs/Layouts	Greening

Condition of roads	Plot development ratios	Presence of trees/shrubs in compounds
Condition of drainage	Plot setbacks (back &sides)	Presence of street trees
Condition of road verges	Roof gutters for channelisation of rainfall	
Effective width of roads	Paved or unpaved compound spaces	
Evidence of flooding/Erosion		

Source: Author, 2021

3.1 The Study Area

The study area is the Bendel Development and Property Authority (BDPA) Housing Estate which is located in Ugbowo, Benin City. The estate was designed in the late 1970s by the BDPA, an agency of the then government of Bendel State (which was split into Edo and Delta states in 1991). The Authority was founded in 1968 to execute property management, property development and urban planning functions. The BDPA was a state-wide agency which took over the planning responsibilities of the Benin City Council. It was in the discharge of the property development function that the study area was developed into a government housing estate. It was a partnership between the state government and the agency. The project was a site and services scheme.

The houses in the estate were not all built by the agency. Rather, it put up six houses only and invited the public to apply for allotments of the remaining space. This was done in three phases. Allottees of the land were expected to build their own dwellings in a like manner. Three crucial issues were as follows:
(i) the estate was designed for residential development, although provisions were made for a shopping zone and a police station;
(ii) there was a restriction of building height to one level only.
(iii)the road network was carved out by the agency with the Bendel State government taking up responsibility for paving and drainage construction.

4.0 Results and Discussion

The results of the physical survey are shown in Table 2. The issues are stated and their manifestations described.

The objective of seeking evidence of physical degradation was gathered by inspection. Inspection was also the means of achieving the second objective of ascertaining land development practices. Evidence for this was interpreted from the physical state of the curtilages within the estate. The third objective of assigning responsibility for deficient practices was done by interpretative analysis of the roles of the regulatory authority authorities and individuals in the system.

Table 2: Evidence of Environmental Degradation in the BDPA Estate

External*(outside the curtilage)*		***Internal****(within the curtilage)*	
Identified Issue	Manifestation	Identified Issue	Manifestation

Mainly absent greening	Poor ecosystem/Proneness to heat island effect/ Erosion	Violation of site coverage rule(over-development)	Creates erosion in the streets via a greater use intensity which leads to more runoff/ Also, narrows streets through use as parking space
Absent channelisation for storm water	Creates soil erosion/siltation	Violation of front & side set-back rules	Creates congested streets through use for car parking/Greater stress on streets
Unpaved streets	Produces erosion of soil	Fences erected too close to the road	Creates narrower streets through smaller or absent setbacks
Non-Residential development	Increases vehicular traffic/use intensity of roads/greater wear	Absent or inadequate greening	Produces soil erosion in the streets through runoffs
A lack of open & recreational spaces	Concentrates all outdoor activity on the streets leading to a greater wear	Concreted /stone paved curtilages	Results in less infiltration/More surface runoff on streets which have no drainage channels/More Erosion/Siltation
		Steep roofs without roof gutters/channelisation	Generates more storm water flow on streets without drainage channels leading to erosion & siltation

Source: Author's Fieldwork (2021)

The internal environment refers to the curtilage of individual properties whilst the external environment refers to the streets or spaces outside the individual house. The issues raised are those which are observed to constitute evidence of degradation in the inspected environment. The manifestations refer to the signs produced by the identified evidence and consequences which they are seen to create and accentuate.

In the discussion which now follows, these results are considered.

There is visible evidence of environmental degradation in the study area. This has been gradual and taken place over the years. The changes have been wrought by human actions of commission and omission as revealed by the literature review. The most visible evidence of degradation is evident in the incidence of soil erosion which has washed a lot of soil off the untarred roads and created gullies which make the terrain uneven and uncomfortable for motoring. Erosion is precipitated by flooding which in turn is exacerbated by a high level of surface run-off which cannot be handled by drainage channels. The absence of street drainage channels is a contributory factor to flooding. Additionally, the penchant for paved compounds which make rainfall infiltration virtually impossible, increases the volume of storm water which flows out of compounds on to the unpaved streets. Efiong & Uzoezie (2017) acknowledge this as a major factor

in their study of Calabar which revealed that paved compound spaces reduces infiltration, increases runoff, and therefore, flooding. This leads the authors to recommend that land development practices should not negatively impact the local hydrological cycle. The inevitable outcome increased erosion is a breakdown of the top soil, its denudation and washing off. A repetition of the process through subsequent rainfalls and flooding events leads to the loss of more soil, creating potholes. Soil denudation gradually reduces the gradient of the street, leaving the buildings and compounds at a relatively higher level.

A second contributory factor to the degradation observed is the absence or inadequacy of trees and greenery generally on the streets and in individual compounds. This contributes to degradation in more than one sense. First, regarding individual compounds, the absence of greening means that advantage provided by the canopies of trees by deflecting the force of falling rain is lost to the environment. As a consequence, rainfall produces more impact, particularly as most compounds are paved and infiltration is limited. Second, regarding the streets, trees have the capacity to check erosion, especially if properly positioned as planned infrastructure. Their absence means that this advantage is lost and the impact of erosion accentuated.

Thirdly, the estate was designed and built for residential use. However, this residential character has essentially changed to commercial. In a planned system of urban management, such changes may not be possible and would always require permission where they are possible. Such permissions may be limited to light commercial uses which would not adversely affect the residential character of the estate. In the BDPA estate, there has been a conversion to various types of non-residential uses. These include vehicle terminals, workshops, religious places, industrial, educational, hospital and business uses. This has a potential to contribute to environmental degradation by increasing the use intensity of land. Facilities and infrastructure, generally, would tend to wear out more rapidly if they are used by more people than they were designed for, and more often than they were previously. Therefore, the roads designed for a purely residential BDPA estate in the 1980s cannot be reasonably expected to hold out with an increase in its use intensity, given systemically poor maintenance practices. Residential use of land is quiet in nature whilst commercial use creates noise and environmental stress by bringing in more people and vehicles which leave a more significant carbon trail.

Fourth, the most crucial factor in the observed environmental degradation in the study area is the obviously high concentration of human and vehicular traffic. Figures are not available, but observation reveals the continual movement of cars, buses, commercial tricycles and other vehicles along the estate's roads. Such traffic is evidence of environmental stress. The population does not accord with the original character of a residential estate. The estate originally consisted of bungalows, but these family dwellings either were modified. These modifications mainly were for off-campus residences of students of the University of Benin which is located opposite the estate. Some of the buildings gave way to more intensive development. The population increase over the years changed the medium density family residential character of the location.

Fifthly, the impact of property development practices on the study area are as important as seeking solutions to the environmental challenges to which they give rise. Having mentioned in the introduction that successful physical and sustainable development is a shared responsibility, the

first step in this direction is to consider the ways in which the two partners in development have contributed to the BDPA situation. Table 3 presents the analysis of responsibility by identifying the root causes of each defect. What is described as the root causes are not findings of the study *per se*, rather they arise from the grounds under whose existence such defects become possible. The table shows that both the planning authority and the developer share responsibility, but not equally. The regulatory authority is found to be culpable in crucial areas where the developer has no role. These are in regard to design and implementation of the physical plan. Achieving sustainable physical development, according to Lohmann (2006), requires continuous and deliberate efforts to create the best possible environment for living and working. This necessarily requires the authorities to set the right standards, but also, to restrain, constrain and coerce developers into compliance with rules which are designed in the best interest of society (Roberts, 1991). The provision and maintenance of paved streets and a sustainable channelisation of water are a crucial aspects of a sustainable plan implementation for a resilient environment. These are exclusively the responsibility of the original developer of the estate (which happened to be also the regulatory authority at the time), not the subsequent individual developers (or re-developers) in this study.

It is of some relevance to mention here that previous studies (Ogeah & Omofonmwan, 2013; Adamolekun *et al*., 2017) have identified a low awareness amongst developers as a factor in non-compliant development in the study area. This factor still lays the blame at the doorstep of the regulatory authority whose responsibility includes explanation and implementation of the planning laws. Widespread awareness may also have been affected by the distance created by the expressed preference for a centralisation, rather than the continued localisation of planning in the Benin City Council. It has been observed by Onwuanyi & Ojo (2021) that the effect has been to *"centralise a function which was previously localised in the city councils. This might have made monitoring less effective, and therefore, increased the numbers of unplanned, unapproved and non-conforming development"* (Onwuanyi &Ojo, 2021, p.229).

Investigations reveal that the present state of the BDPA estate was shaped by the following main factors.

(i) In the late 1970s and early 80s, the study area, located opposite the University of Benin, was at the city outskirts, a mainly undesired location to the general public which was invited to apply for the building plots. The main allottees of the land were senior civil servants. The low uptake meant that the estate did not grow as quickly as intended by the authorities.

(ii) The then rural location of the study area at inception was contributory to poor monitoring and management. Thus, the restrictions of height (one level) and use (residential) were neither maintained nor enforced. As a result, *laissez faire* practices were introduced by allottees and those to whom they resold their allocations. Changes of use became common and the residential character became lost.

(iii)Non-compliance with the height and use restrictions created overpopulation, congestion and poor aesthetics.

Table 3: Reasons and Responsibility for Environmental Degradation in the BDPA Estate

Evidence	Root Cause(s)	Responsibility
Street erosion	Non-construction of roads & drainage channels	State Government
A lack of open & recreational spaces	Poor conceptualisation & implementation of physical planning for the estate project	BDPA
Violation of site coverage rule(over-development)	Ineffective development monitoring/ Developer's ignorance or defiance	BDPA/Individual developers
Violation of front & side set-back rules	Ineffective development monitoring/ Developer's ignorance or defiance	BDPA/Individual developers
Fencing too close to the road	Ineffective development monitoring/ Developer's ignorance or defiance	BDPA/Individual developers
Inadequate/Absent greening(Internal)	Outdated development policy /Developer's ignorance	BDPA/Individual developers
Concrete paving of compound space	Outdated development policy/ Developer's ignorance	BDPA/Individual developers
Unapproved development/Change of use	Ineffective development monitoring/Developer's ignorance or defiance	BDPA/Individual developers
Violation of Height Restriction	Ineffective monitoring/Enforcement	BDPA

Source: Authors' Fieldwork & Analysis (2021)

In sum, the land development deficiencies observed in the study area suggest a current inability to meet Steiner's (2009) recommendation that a modern city would be successful if it could demonstrate green credentials capable of protecting residents from present and future impacts of climate change. Failure in this regard, as observed in the study area, creates a vulnerable environment.

5.0 Practical Implications

Since the identified practices do not promote a sustainable and resilient environment, their perpetuation inevitably implies that environmental degradation will worsen in the study area.

6.0 Conclusion

This study aimed at investigating how land development and management practices may be contributory to the physical environmental degradation observed in the BDPA Estate in Benin City. The investigation was done by physical observation during which evidence of degradation was collated and analysed. The root causes were thereafter traced, explained and responsibility for the deficits established. The conclusion suggests that land development and management practices negatively impact the physical environment in the study area. These deficits are ascribable to both

the regulatory authority, government and developers. However, this is not in equal measure as the first and second parties bear the larger responsibility for their failure to make the right choices in the interests of society by creating the best possible conditions for living(Lohmann,2006) and coercing defaulters into compliance(Roberts,1999).

The findings reveal that defective land development practice is contributory to physical environmental degradation in the study area. Furthermore, these defective practices arise from the acts of commission and omission of the regulatory authorities and individual developers. Again, non-compliant development and environmental nuisance is the outcome of failure on the part of the regulatory authorities. Finally, the BDPA as initiator, developer and regulatory authority bears full responsibility for the deficit of poor plan implementation.

The findings mean that physical environmental degradation in the estate is attributable to inappropriate land development practices which the BDPA has either neglected, failed or refused to monitor. In addition, ineffective regulation, particularly the absence of greening and the enforcement of extant rules in the study area suggest that physical degradation would continue. Finally, the failure of government (through the Ministry of Infrastructure) to arrest the deterioration by providing paved roads and storm water channelisation is a threat to environmental sustainability and resilience in the study area. Lastly, the poor implementation of the estate plan suggests a lack of capacity of the BDPA to discharge its urban environmental management responsibility. This aligns with the view that a relationship exists between effective urban planning and sustainable urban environments.

Following from the finding that regulation has been ineffective and governance negligent in arresting environmental degradation, the study recommends environmental greening, better regulation and monitoring and the provision of paved roads and appropriate drainage in the study area. The growing threats of climate change makes these steps highly imperative.

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