URBAN FORM AND ENVIRONMENTAL SUSTAINABILITY IN NIGERIA: REMOTE CONTROL FOR HOUSING TYPE AND DENSITY

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ABSTRACT

In Nigeria, Urban planning is still on it array of coordinating, high-density, and mixed-use urban form. Many of the claims made by relevant physical planning authorities to enforce and control development as well as urban forms in terms of the environmental sustainability benefits are contested, and few have been rigorously reply with modern techniques towards ensuring a health pleasing environment. Drawing upon policy had brought two key dimensions of urban form and environmental sustainability. The principle of social equity and sustainability of built environment. This study review data from the Survey of cities formation and housing development in Nigeria. This paper examined key aspects of urban form, density, and housing type, and selected environmental sustainability outcomes. Moderate analyses suggest a strong relationships between urban form and a range of outcomes, although in opposite directions for the environmental (land) justice, equity and community dimensions. However, the impact of urban form on these outcomes is substantially modified once we control for exogenous and intervening demo-graphic and socioeconomic factors. In addition, outcome patterns relating to access to services and facilities favour denser urban forms at the same time as outcomes relating to sustainability of community facilities remain adverse in denser areas. This suggests trade-offs within the dimensions of environmental sustainability, as well as between the socio-cultural, environmental, and economic dimensions which push cities dwellers within the systemic urban settings in Nigeria.

KEYWORDS: **Urban form, Mixed-use, Planning, Housing type, Density, Environmental sustainability**

1.0 INTRODUCTION

The planning and design of sustainable housing are essential. "Everyone has the right built to an environment that is not harmful to their health or well-being; and to have the environment protected for the benefit of present and future generations through reasonable legislative and other measures that prevent pollution and ecological degradation promote conservation and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development" (United Nations 1997). Built environment, or built world provide the setting for human activity, ranging in scale from buildings to parks, space in which people live, work, and recreate on a day-to-day basis. This paper examine the nature of urban form, housing type and density as a major issue confronting environmental sustainability, as part of a wider study of sustainable urban form. UN-HABITAT (2009), as cities experience demographic growth, they tend to expand spatially. One consequence of this process is the merging of previously non-adjourning towns and cities, resulting in metropolitisation in some cases, or uncontrolled peri-urbanization (which often appears chaotic) in others as well as conversion of rural land in to urban uses and engulfment of

adjacent municipalities by large cities to constitute new metro areas. Cities such as Bangkok, Beijing, Jakarta, Kolkata, Lagos, Manila and Sao Paulo have expanded spatially to engulf swathes of neighbourhood rural land and previously independent municpalitis.

Urban form is the physical characteristics that make up built-up areas, including the shape, size, density and configuration of settlements. It can be considered at different scales ranging from regional, urban, neighbourhood, block and street. Urban form evolves constantly in response to social, environmental, economic, technological developments; planning, housing, urban policies; health, transport and economic policies. Sustainable Urban Form needs to be considered in relation to infrastructure. Successful infrastructure meets demand and provides reliable, cost effective, and high-quality services. Other important infrastructure aspects include the affordability and accessibility of services and the resilience and sustainability of infrastructure. However, in the Nigeria, the National Infrastructure Plan takes a sectoral approach rather than a spatial one. That is putting infrastructure in the wrong places. Housing form and environmental design is to gain a better understanding of human settlement and their well being to improved physical surroundings.

Environment enhances the development and well being of any community, and supports healthier communities. The quality of environment is determined by maintenance and arrangement of houses, the presence, quality and accessibility of facilities, security, and street cleanliness in the residential area. Poorly constructed houses lead to stress on occupants with increasing exposure to pollutants resulting to non habitable units. This paper analyses the relationship between key aspects of urban form, density, and housing type, and selected social sustainability outcomes. Simpler analyses suggest strong relationships between urban form and a range of outcomes. However, the impact of urban form on these outcomes is substantially modified once we control for exogenous and intervening demo-graphic and socioeconomic factors. In addition, outcome patterns relating to access to services and facilities favour denser urban forms at the same time as outcomes relating to sustainability of community remain adverse in denser areas. This suggests trade-offs within the social dimensions of sustainability, as well as between the social, environmental, and economic dimensions. Sustainable communities tend to have lower transportation costs, less traffic and more economic in terms of housing and market demands, decreasing costs in terms of infrastructure, reduced air pollution and the ability to create a safer environment. Quality of life is a main objective of sustainable development and principle of planning for human wellbeing is thus of paramount importance and hinges significantly on immediate and visual changes to lifestyle.

The major features of sustainable housing for community development include; ecological protection, density and urban design, local economy, sustainable transport, affordable housing, liveable community, sewage and storm water, water, energy and construction waste recycling, environmental sound building materials, provision of in-housing recycling areas (Peck & Dauncey, 2002). Housing forms and sustainable community reflect both the natural environment and human nature. In this regard the use of appropriate technology is invaluable.

2.0 MATERIALS AND METHOD

Housing is an important factor in the recognition of any given community as a success among nations. It is difficult to talk about the success of a nation, or a community within a nation without analyzing its housing situation. Alao D. A. (2009), housing provides a link between the physical development of a city, and its social and economic outcomes. The availability of decent housing for each family defines the level of development which the country has reached. This is because the social and economic wealth of the country can only co-exist with good housing. Housing is not concerned with the design of a specific housing unit. It is concerned with the design of a whole housing environment which includes accommodation,

jobs, education, and health services amongst others in a context which is accessible, safe, hygienic, aesthetically pleasing and also sustainable.

In Abuja the Federal Capital Territory, house building were planned around infrastructure new roads, rail networks, water and sewer pipes, schools and hospitals. Land and resources were used rationally to meet housing need. By contrast, the 1992s, 2003s, and 22013s witnessed a growing disconnect between urban form, land use and infrastructure. This resulted in peripheral, car-based housing estates, increased suburbanisation and dispersed development. Much housing over for decades were developed without adequate infrastructure.

2.1 Urban Form Measures

The elements of urban form which can be measured at National Population Commission in Nigeria depend solely from census data are:

- Density (gross residential), measured (preferably) in terms of dwellings (`spaces'), or habitable rooms, per hectare;
- House type mix, expressed as the proportion of flats, detached, semidetached, or terraced houses;
- Presence of high(er) residential buildings,
- proxy by households whose lowest floor of accommodation is above various floor levels;
- Density of cars, relative to space, dwellings, or households, can also be measured

2.2 Housing type and Gross Dwelling Unit Density

Studies of existing built areas indicate that the same array of housing types can produce different gross dwelling unit densities through different street configurations, block sizes, lot sizes, site layouts, and designs. Conversely, States with different mixes of housing types can have the same density. While net dwelling unit density is closely related to floor area and therefore built form, gross density depends on the amount of undevelopable and public land within the gross land area. Since some types of public land are allocated in proportion to population, increasing net density through higher-rise forms produces diminishing returns in terms of gross density. The maximum carrying capacity of a given land area is reached when the amount of public land required to serve the population begins to compete with the land required to house it. Beyond this point, one can increase only at the expense of the other.

2.3 Net Residential Dwelling Unit Density

Table 2, shows the housing type of each selected urban area in ascending order of dwelling unit density calculated in relation to the net residential parcel area. In Nigeria, cities like Lagos, Kano, Ibadan, Benin, Enugu, the higher the density, the lower the proportion of single-detached dwellings. The proportion of the different housing types of attached dwellings varies greatly from one state to another. It must be noted that there are some limitations to these measures. Net residential density cannot be measured from census data, because COAs cover all land uses, not just housing, and they may comprise widely varying quantities and qualities of non housing land uses. Aspects of urban form which the census cannot measure include quality of design, type of building and street layout, open space, and mixed use. The most important single aspect of urban form is probably density, because it is a general summary measure which many other features will be partly correlated with. The `compact city' concept implies relatively high density. The author focused on room density (habitable rooms per hectare), because this arguably captures best the intensity of the built structures. However, further examination of correlations and factor analysis outputs for urban-form-related

measures, as well as examination of relationships with certain key outcomes, suggested that dwelling unit density would be better used as a single best representative measure. Nevertheless, the very high correlation between dwelling and room density (r . 0:974) should be noted.

All the density measures are subject to a degree of imprecision and we control for extreme high outlier so for example, we set arbitrary maximum values of 400 rooms per hectare for room density and 250 dwellings per hectare for dwelling density, based on inspection of the distribution of COA values. Turning to the measures of social sustainability `outcomes', the most important are arguably those reflecting people's overall satisfaction with their local area.

These capture the dimensions of attachment to/pride of place and (indirectly) residential stability, insofar as people who are less satisfied are more likely to move on.(4) Satisfaction with area is based on a five-point scale from' very satisfied/fairly satisfied' through to `very dissatisfied'; the overall distribution of responses is shown in table 1, and indicates relatively low numbers recording dissatisfaction. On the basis of City Form consortium household survey evidence, Bramley et al (2007) show that the area dissatisfaction measure represents the best overall summary measure of the range of social sustainability aspects, as defined in this paper.

Density expresses the ratio between a building's total floor area and its site coverage. To calculate floor area ratio, the gross square footage of a building is divided by the total area of its lot. The term **housing density** is an urban planning term used measure degree of the built or to-be built residential accommodation, being the number of persons or dwellings situated on a unit of area such as acre/hectare of a particular site or district. Urban density is a very specific measurement of the population of an urbanized area, excluding non-urban land-uses. Floor area ratio - the total floor area of buildings divided by land area of the lot upon which the buildings are built. Residential density is the number of dwelling units in any given area. Net Residential Density (NRD) is number of dwellings divide by net residential while, Floor Area Ratio (FAR) refers to the ratio of total net floor area of a building to the total lot area. Floor Area Ratio describes the intensity of the use on a site. Gross density is the total number of units just as gross revenue is the total number of Nigerian naira taken in by a business Factors affecting population density. Gross residential density is obtained by dividing all land in a defined area used for residences, streets, education/schools, local parks and local shopping facilities in to the total number of families per area.

2.4 Housing Forms in Nigeria

The traditional building materials of these houses are also determined by the local environment. The principal building materials used in traditional houses in Nigeria include mud, wood, straw, palm fronds and raffia matting.

2.5 Types of Housing in Nigeria

Housing types can be classified in to single-detached, semi-detached, row house, duplex apartments, apartments in buildings under five storeys, and apartments in buildings of five or more storeys. In this study apartments and duplexes are considered to be **non-ground-related housing** that is, individual dwelling units have no direct access to the street. Single-detached, semi-detached, and row houses are considered ground-related, meaning that units have direct access to the street. Other types of housing classification includes townhouse, cottage, flat, hut, Duplex/Triplex. Condominiums are a form of ownership that can apply to almost all types of housing. Detached house is a house that stands on its own. Townhouse is a unit in a row of other units that look like houses, attached to each other.

Three Dimensions of Sustainability and Sustainable development is now commonly classified as having three main components: Economic Sustainability, Environmental sustainability and

Social sustainability (this final 25 element sometimes being referred to as equity, thus giving the so called three Es: Economics; Environment and Equity). (Pitts 2004). Therefore, there are three dimensions of sustainable development: The Social Dimension, which covers cultural identity, empowerment, accessibility, stability and equity; The Economic Dimension, which includes growth, development, productivity and tickle-down; and The environmental Dimension including ecosystem integrity, carrying capacity and biodiversity The linkages between these different dimensions of sustainability should be fully taken into account, and they should not be isolated from one another (Khan, 1995; Goodland and Daly, 1996; Mitlin and Satterthwaite, 1996, Hart, 1999; Williams, et al, 2000; Chiu, 2003) in (Vehbi, Hoskara & Hoskara 2009).

Principles of Sustainability according to Plessis (1999) analyzed, a key element of a sustainable environment is its ability to foster social cohesion and provide security for all who live in it. It would appear that there are various social and environmental factors that greatly influence both crime and sustainability. This includes Poverty, Equity and ownership, Quality of the environment, Access to Infrastructure, facilities and services.

2.7 Characteristics and Goals of Housing Form and Sustainable Community

1. Place a high value on quality of life. A sustainable community accepts that communities are first and foremost for people and that the primary objective of the planning and development process is to improve the quality of life of its residents, socially, economically, psychologically, and spiritually.

2. Respect the natural environment. A sustainable community recognizes its relationship to nature and sees nature's systems and components as essential to its well-being.

3. It provides access to nature through metropolitan parks, open-space zones, and urban gardens.

4. A sustainable community takes an inventory of its human, natural, and economic resources and understands their finite quality. It ensures that forests are not overused, and the places of the built environment are not stagnant and empty.

5. Maintain scale and capacity. A sustainable community recognizes the importance of scale and capacity, with regard to the natural and human environment. It ensures that the environment is not overdeveloped, overbuilt, overused, or overpopulated.

3.0 RESULTS AND DISCUSSION

Table 1.Population of selected state

Rank	City	State	Population	Area (km^2)	Density ($/km^2$)
1	Abuja	Abuja	1580,000	225	7000
2	Benin City	Edo	1,355,000	228	5,900
3	Lagos	Lagos	12,830,000	1,425	9000
4	Kano	Kano	3,680,000	2515	14,600
5	Ibadan	Oyo	2,910,000	466	6,200

Source: Adapted from Demographia's "World Urban Areas" study 2016.

Table 2. Distribution of urban form

Area	satisfaction	Number	Percentage
Abuja	Very satisfied	3 706	17.83
Benin city	Fairly satisfied	3 859	18.57
Lagos	Neither satisfied nor dissatisfied	4 361	20.98
Kano	Slightly dissatisfied	5 161	24.83
Ibadan	Very dissatisfied	3 698	17.79
	Total	20785	100.00

Source: Author survey, 2019.

Table 3. Distribution of housing type

	satisfaction	Number	Percentage
Abuja	Very satisfied	3 706	17.83
Benin city	Fairly satisfied	3 859	18.57
Lagos	Neither satisfied nor dissatisfied	4 361	20.98
Kano	Slightly dissatisfied	5 161	24.83
Ibadan	Very dissatisfied	3 698	17.79
	Total	20785	100.00

Source: Author survey, 2019.

Table 4. Distribution of housing density

Access to facilities and service	satisfaction	Number	Percentage
Abuja	Very satisfied	3 706	17.83
Benin city	Fairly satisfied	3 859	18.57
Lagos	Neither satisfied nor dissatisfied	4 361	20.98
Kano	Slightly dissatisfied	5 161	24.83
Ibadan	Very dissatisfied	3 698	17.79
	Total	20785	100.00

Source: Author survey, 2019.

Table 5. Housing form and environmental sustainability

Housing type and Density	Satisfaction	Number	Percentage
Abuja	Very satisfied	3 706	17.83
Benin city	Fairly satisfied	3 859	18.57
Lagos	Neither satisfied nor dissatisfied	4 361	20.98
Kano	Slightly dissatisfied	5 161	24.83
Ibadan	Very dissatisfied	3 698	17.79
	Total	20785	100.00

Source: Source: Author survey, 2019.



Plate 1. Housing form, type and density kano
Source: www. Google search.com, 2019



Plate 2. Housing form, type and density kano
Source: www. Google search.com, 2019

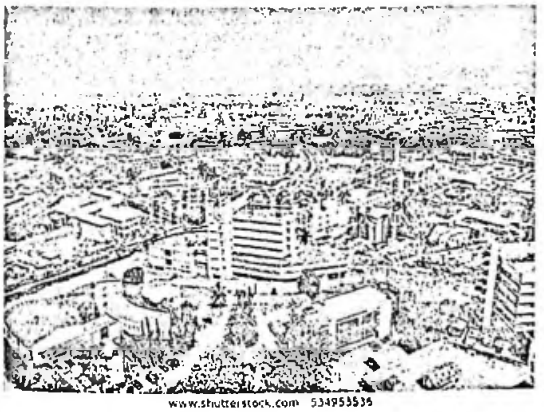


Plate 3. Urban form, Housing type and density Ibadan.
Source: www. Google search.com, 2018

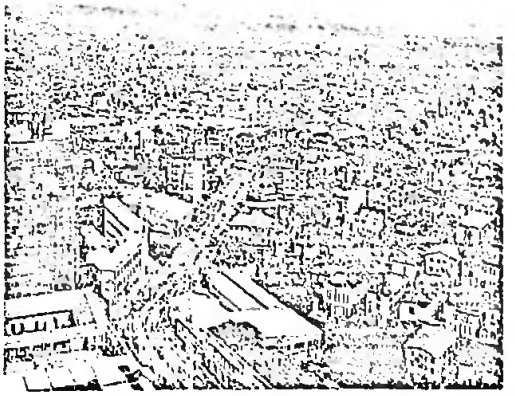


Plate 4. Urban form, Housing type and density Ibadan
Source: www. Google search.com, 2018.

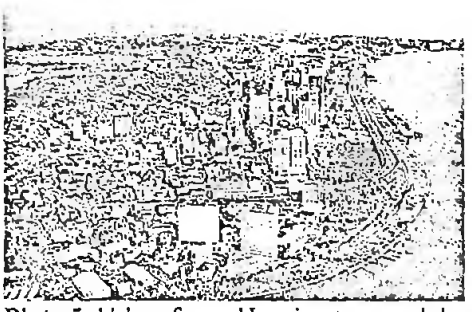


Plate 5. Urban form, Housing type and density Lagos
Source: www. Google search.com, 2018.

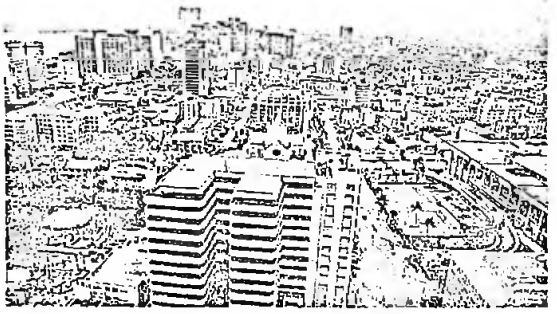


Plate 6. Urban form, Housing type and density Lagos
Source: www. Google search.com, 2018.

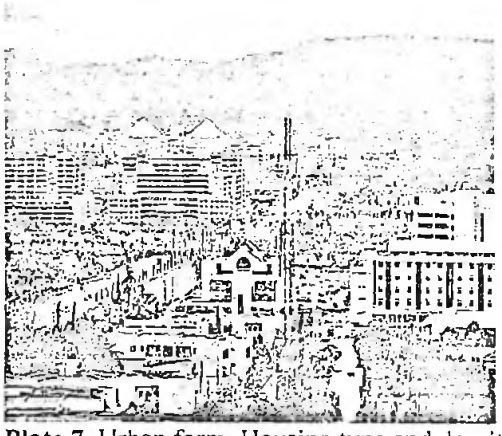


Plate 7. Urban form, Housing type and density Abuja
Source: www. Google search.com, 2018

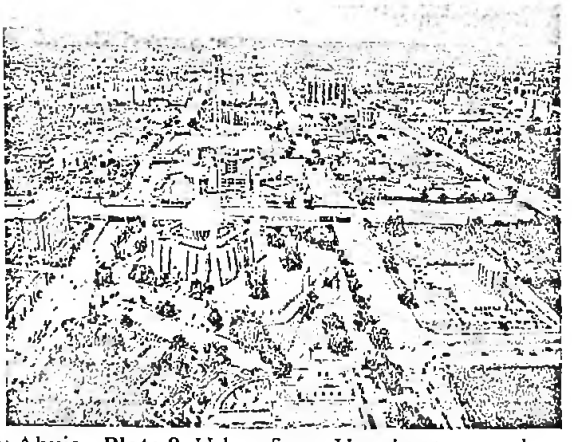


Plate 8. Urban form, Housing type and density Abuja
Source: www. Google search.com, 2018.

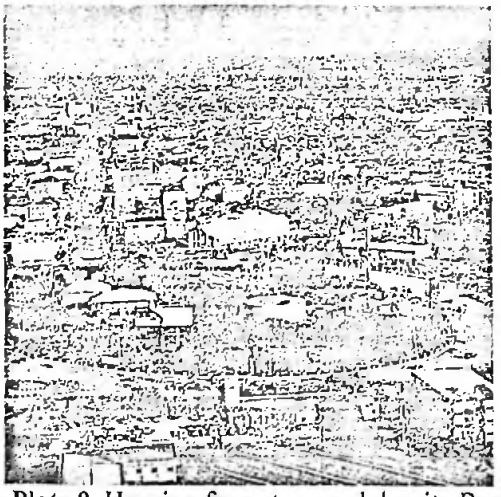


Plate 9. Housing form, type and density Benin City
Source: www. Google search.com, 2018.



Plate 10. Environmental Sustainability
Source: www. Google search.com, 2018

Simple descriptive data on the patterns of key research outcome indicators an apparently clear picture. Dissatisfaction with area is quite strongly related to densely urban form, the dissatisfaction rate rising quite strongly with density. Table1 show that this applies even after

controlling for household type or tenure. Similar patterns apply to common urban housing problems, and to a number of other indicators of satisfaction. The more adverse picture for higher densities may reflect a greater incidence of problems, but also a greater tendency for any problems to impinge on residents when they live much closer together. Many (if not all) of these problems reflect negative interactions between residents and the environment.

Table 6: Comparison of housing form, environment quality, housing type and density

Housing form	Environmental quality	Housing type	Housing density
Compact, medium to high density forms	High density forms	Optimum density	Compact urban form
Mixed land use	Mixed land use	Mixed land use	Housing in close proximity to other functions
Public transport orientation	Emphasis on public transportation	Public transportation	Public transportation
Pedestrian friendly streets		Pedestrian friendly streets and developments	Pedestrian friendly developments
Well defined public spaces	Open spaces	Open spaces and landscaping	Sense of place
Integration of development and nature	Creation of natural habitats integrated with housing		Wild life conservation
		Energy efficient house design and orientation	Energy sufficient house design
	Recycling / Re-use		Re-use, recycling and avoiding waste
Development dictated by cycling and walking distances	Recycling / Re-use	Community development	Community development and safety
	Pollution and waste strategies		Minimize waste and pollution

Source: Source: Author survey, 2009.

Tables above, implies that the population is high relative to the size of the city. Large cities such as Lagos city, Kano city and Ibadan have a high housing density. Cities, such as Benin

and Abuja have very low densities. Though this low density is skewed by the fact Benin and Abuja are considered as host of hospitality.

3.1 Urban Form and Housing Problems in Nigeria

Alao (2009).The Nigerian Government, in the past few years, has made the provision of housing for its inhabitants an important issue. One of the most significant efforts is that they have co-worked with private organizations in the design, construction and implementation of housing projects throughout the country.

Despite their efforts to improve the housing situation of the country, about 90% of urban housing is produced by private investors. In Nigeria, like in any other developing country, when we talk about provision of housing, it is usually for the high, medium and medium density lead to the construction of different mass housing schemes to combat housing shortage in the country but on practical note turned to dribbled game. The housing problems in Nigeria ranges from safety and security, affordability, accessibility, infrastructures and support facilities, quality of housing, variety of housing types, location of housing, supply of housing.

3.2 Implications for Planning

Urban forms can be described as successful when they underpin the functioning of an array of urban systems, use resources sustainably, and provide a sound economic base which enables a good quality of life for its inhabitants. They can also withstand shocks, and are able to 'bounce back' or improve their conditions post-shock (whether that shock be environmental, economic and/or social such as shrinking cities, peak energy and climate crises). Many poorly planned places in the world will need extensive retrofitting in the years to come. We need to plan actively to allow for new development to be located in sustainable places, with the right infrastructure, taking a spatial approach in response to rising inequality, an ageing population and climate change.

Planning on a local and regional scale should start with mapping infrastructure and deciding which sites to prioritise for development. As infrastructure is costly to put into place, it makes sense to locate new developments in areas of spare capacity, such as from energy and water networks, or in terms of local education and healthcare facilities. It can be challenging to reconcile individual preferences on housing location with societal and environmental capacities. However in many cases, the decision to live in the suburbs is based on price rather than personal preference, raising the wider question of housing affordability.

4.0 CONCLUSIONS AND RECOMMENDATIONS

The researcher mapped out the development of his understanding of the concept of housing form and sustainable development which incorporates both social equity issues and sustainability of community issues.

In the empirical part of the paper, using data from the National population Census (2006) and other sources, we examined some of the challenges confronting housing type housing density and. The pattern of housing type and density using descriptive statistics to assess the different aspects of urban form, while taking account of other variables on service access. This study focused on the three representative measures of area dissatisfaction, urban form and problems, access to local services. More dense (compact) urban forms, and their associated housing types, tend to be associated with somewhat worse outcomes in relation to dissatisfaction with the state and perhaps more strongly with the incidence of urban problems. At the same time, it is clear that the socio demographic composition of cities development. Urban form, housing type, density is an important aspect when looking at the well being of any nation, but these developments were taken different dimension in terms designs, material used for construction, level occupants. The concept of Sustainability has been developed to provide a solution to the issues and problems which are faced by many developed and

developing countries not only in terms of housing. Dispersed housing or settlements typically result in higher levels of greenhouse gas emissions and resource consumption such as land, energy and water than compact settlements. This is attributable to increased car-dependency and energy consumption associated with low-density housing, coupled with the increased embodied energy during infrastructure provision. Dispersed housing settlements may also cover land with value for future climate adaptation, such as green spaces which mitigate against flood risk.

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