Impact of rapid population growth on public housing schemes and the influence on city resilience

Enobong B. Equere*, Eziyi O. Ibem†, Oluwole A. Alagbe‡
Department of Architecture, Covenant University, Ota, Nigeria.

Abstract. Rapid population growth in urban centres has been identified as a threat to city resilience. However, in a developing country like Nigeria, there is a dearth of research on how impacts of rapid population growth on public housing schemes influence city resilience. This study evaluated selected public housing schemes in Abuja, Nigeria, to determine factors of the residents’ perception of impacts of rapid population growth on the housing estates they lived. This was with a view to assessing how these factors influence city resilience. Data for this study were collected from questionnaire administered to 345 residents of the selected public housing estates. The resident samples were asked to indicate their level of agreement/disagreement with 26 statements describing the possible impacts of rapid population growth in the housing estates they lived. The questionnaire was based on a 5-point Likert type scale ranging from 1=Strongly Disagree to 5=Strongly Agree. The data obtained were analysed using descriptive statistics, factor analysis and Principal Component Analysis (PCA) to identify the key factors. The result reveals a mean score of 3.59, showing that the residents were in agreement on a rapid increase in population of people living in the estates. In addition, the result reveals a difference between the mean score of residents’ level of satisfaction with the house types meeting their need when they first moved into the estate (3.77) and the extent to which the same house type still satisfies their household need at the time the survey was conducted (3.18). Furthermore, seven factors of residents’ perception of impacts of rapid population growth on the estates emerged from the analysis. The first factor, which accounted for around 11.05% of the variance in the data, comprised need for the addition of more rooms in the dwelling units, consideration of distance of estates to place of work and the economic situation of residents in the estates. The application of this result to housing that influence city resilience is drawn from previous study which identified five key factors of housing that influence resilience and adaptation to stress. The result reveals that none of the seven factors of impact of rapid population growth on the estates that emerged in the current study appears as a factor that influences housing resilience and adaptation to stress. This study implies that for public housing schemes in developing countries like Nigeria to influence city resilience, housing designers and developers should consider factors of housing that are more likely to adapt to the stress of increasing population.

1. Introduction
Rapid growth in human population in urban centres and growing mega-cities has been identified as a threat to city resilience [1, 2]. In her report on Visions of a Resilient City, [1] noted that cities, particularly in the developing world, face numerous challenges of meeting rising demands for housing in responding to a growing urban population, thereby threatening the resilience of their cities. This is seen as an indication of the need for more resilient cities that have the capacity to withstand the shocks of population growth [3, 4]. Urban resilience has been defined as the capacity of a city to respond and adapt to changing circumstances, which include climate change, rapid population increase and economic vitality [1, 2, 5].

For cities to increase their capacity for resilience, it is important that building design strategies are capable of responding to the socio-economic, physical and environmental stresses of the city [6, 7, 8].
This suggests that strategies for housing for resilient city in the face of rapid population growth should adapt to the socio-economic and environmental challenges such influx may generate if city resilience is to be achieved. This calls for further research into dimensions of impact of rapid population growth on the socio-economic and environmental fabrics of housing in cities prone to such threat. However, there is a dearth of research on how dimensions of the impacts of rapid population growth on the socio-economic and environmental fabrics of public housing developments influence city resilience. This study seeks to fill this gap.

The study, therefore, identifies from the literature, social, economic and environmental characteristics of housing that would foster cities resilient to impacts of rapid population growth. In this regard, the study evaluated the residents’ perception of the impacts of population growth on the socio-economic and environmental fabrics of selected public housing schemes, with the aim of assessing how the factors have influenced the resilience of the city. The two main research questions the study sought to answer are: What factors of housing are affected by the impact of rapid population growth on the socio-economic and environmental fabrics of public housing estates in Abuja, Nigeria? How do these factors influence the resilience of that city to the impacts of rapid population growth? This study is valuable in identifying specific factors of public housing that are affected by impacts of rapid population growth, and to consider their influence on the resilience of cities in developing countries. This measure is intended to help in reducing the adverse effects of urbanisation on housing and to promote resilience in cities of developing countries.

2. The study area

Abuja was created as a new Federal Capital Territory (FCT) in 1976, moving the capital out of Lagos. Reasons stated for the relocation included, amongst others, poor topography; congestion; overcrowding with limited room for expansion given its coastal border and a decaying and polluted urban environment. It was the expectations, therefore, that the new capital city would be designed to correct the faults and shortfalls of the former capital city; especially in providing enough room for expansion. The FCT spans over 8,000 km² of land, and lies between latitudes 9°1 and 9°20 North of the Equator; and longitudes 6°45 and 7°39 East of the Greenwich Meridian. Figures 1 and 2 show map of the Federal Capital Territory and map of Abuja respectively.

In terms of population projection, the Federal Capital City (FCC) of Abuja was conceived as a city for about 3.2 million people, with an average household size of between 5 persons and 6 persons [9]. This translated to a total projected number of 278,400 households. However, the National Population Commission (NPC) recorded population figure for Abuja in 1991 as 378,671 people, and in 2006 it was 770,000. Subsequently, different studies have recorded varying population estimates and growth rates. For instance, by Population City Estimates [10], the population of Abuja city for the year 2015 was estimated at 2,440,200, being 1.34% of total Nigeria’s population. They further asserted that if population growth rate would be same as in period 1991 to 2015 (an average of 13.91% per year), then Abuja population in 2017 would be 3,166,506. Population City Estimates [10] further estimated the population in the metropolitan area of Abuja to be 6 million persons for year 2016. Figure 3 shows a graphical representation by Population City Estimates, indicating Abuja population history from 1971 to 2015. According to World Bank Report [11], over 50% of people living in Nigeria live in urban areas. Cities with the highest forecast of population growth have been identified as the least resilient within the overall resilience rankings, as seen in a study to quantify the resilience of 50 countries of the world, conducted by The Grosvenor Group Report (GGR) [12]. Planning for housing in the face of such rapid population growth will require innovative strategies if it is to foster a resilient city.
Figure 1: Map of the Federal Capital Territory Showing Planned Phases of Development
Source: Abuja Geographic Information Systems (2000)

Figure 2: Map of Abuja Showing the Five Districts of Planned Phase I
Source: Abuja Geographic Information Systems (2000)
3. Characteristics of housing for resilient cities

Conventional housing designs are primarily configured to shelter, preserve and protect lives and properties of the occupants, as well as achieve conducive spatial provisions for carrying out functions for which such housing was designed. Studies abound on how resilient housing can be achieved. However, [7] posited that resilient housing is critically distinct from housing for resilient cities. While resilient housing would entail characteristics that would offer efficiency in the building itself, housing for resilient city offers characteristics that would enable housing relate efficiently with the exigencies of the city [6]. The literature reviewed identified social, economic and environmental characteristics of housing that promote city resilience. The characteristics identified from the literature constituted the variables used for this study.

3.1 Social Characteristics of Housing for Resilient Cities

The strength of the social structure of a community is an important characteristic if housing for resilient cities is to be achieved [7]. Moreover, socially engaged communities are said to be more resilient [13]. The social structures in a community are the available social networks. They transmit the emotional and cultural meanings of a place [14]. Social networks are assemblages of individuals or groups related to one another through connections such as familial ties, friendship, similar interest, similar beliefs, or other types of common circumstances [14]. Thus they represent the web of relationships that exist among people [15]. The ability to weather a disaster or stress upon a city depends on the size of social networks and the interconnection between the networks. Strong social networks are, therefore, important for city resilience because they contribute significantly in building social cohesion in the community [14]. This is achieved through creating ties. Reference [16] described strong ties as being the emotional intimacy, mutual confidence and reciprocal services. Also, [17] described the strong-weak ties as feelings of responsibility for one’s anonymous neighbours, which brings about the notion of level of trust in a neighbourhood.
3.2 Economic Characteristics of Housing for Resilient Cities

Housing for resilient cities would need to support economic livelihoods of its residents if it is to promote resilience [7]. Economic livelihood strategy usually involves one’s capabilities, material assets, social resources and activities required for a means of living [18]. It also involves the way in which these factors are organized in order to help a household cope with economic stress. The literature highlights three economic livelihood strategies being factors that characterise building capacity for housing for resilience city as: (a) employment pattern (b) income pattern and (c) pattern of investment.

3.2.1 Predominant Employment Pattern. Employment pattern is one of the ways of harnessing the economic livelihood of residents for building resilience capacity. It needs to be related, and not alien to the economic capabilities of the residents. Urban drift in developed countries evolved through the pull theory, where the influx of population was to engage in available industrial or employment opportunities in the city. However, in cities of developing countries, urban drift entails people leaving poorer or rural areas, through the push theory, to seek better living standards in the cities; where there are no readily available jobs. A greater number of the migrants that make up the rapid population growth are people of low skills. The lack of skilled labour in the vast number of people who make up the rapid population growth limits the employment capacity into skilled labour jobs. This lack of skills has led to the generating of private and self-sustaining means of livelihood. The majority of the population live, socialize, and eke out a living outside state regulation in informal economies [19]. The result is the increase in informal and small-scale businesses such as trading, artisanship, tailoring, photography and the likes. Housing for resilient cities would need to take such trend into consideration. It can be deduced that employment patterns and likely predominant sectors in a locality are expected to give direction on income pattern, which would help to determine appropriate housing development approach.

3.2.2 Prevalent Income Pattern. Income pattern is the means, ways or avenues in which members of a household or a community earn money and make a living. Such patterns depend on factors like assets, level of education, occupation and demographic characteristics [20]. In the effort to generate income from all possible sources, members of the households tend to pursue multiple economic activities. Such sources of income and other supplementary sources of income are a total sum of earnings of the members of the household [21]. Studies have shown that housing expenditure that exceeds 30% of the household income is viewed as an indicator of housing affordability problem [22]. However, in African households, around 64% of income is spent on food alone [23]; and around 80% of the household heads spend 50% to 80% of their incomes on household feeding [20]. An understanding and consideration of such prevalent income patterns in the city is, therefore, necessary and should be considered in order to achieve housing for resilient cities.

3.2.3 Flexible Pattern of Investments. Pattern of investment refers to how money or resources are saved, put away from current consumption in expectation of some future yield, income or increased value. Savings are thus said to be the seed of investment, without which there can be hardly any investment [21]. Where housing is concerned, the pattern of investment would be such as can afford housing as at when needed. Considering that a majority of the rapid growing population in cities of developing countries tend to engage in informal business activities, this leads to the need for adopting flexible and adaptable economic system, which would encourage self-employment, promote production, and thus generate a source of income; bearing in mind that income is the primary source from which one can save towards investment.

3.3 Environmental Characteristics of Housing for Resilient Cities

Housing for resilient cities should be able to reduce the vulnerability of residents to environmental risks and stresses [7], more so as may be caused by the trauma of rapid population growth. Such vulnerabilities would include congestion, noise, air and environmental pollution, inadequate and overstretched infrastructure. To sustain the environmental vulnerabilities, characteristics of housing for a resilient city would therefore take into consideration land use, density, size of services and infrastructure.

3.3.1 Efficient Land Use. With rapid population growth the greatest environmental demand would be land for housing to meet the basic needs of housing provision. Land use planning provides basis on which a locality could establish what its pattern of land use ought to be [24]. Such planning can also
be utilized to assess existing development patterns and project growth corridors. Land allocation in a residential neighbourhood vary according to local, physical, and cultural peculiarities; and also, residential land allocation districts are defined by housing unit densities (number of dwelling units per acre). A land use plan for a city with rapid population growth of low-income category and the less privileged, is considered to be of a higher percentage of high density residential land allocation, in order for it to enhance its adaptive capacity and promote resilience.

3.3.2 Appropriate Density. Density is a critical factor in the viability of cities. It is a numerical measure of the concentration of individuals or physical structures within a given geographical unit [25]. Furthermore, a strong community spirit, which is a resilient characteristic, is linked through densities [26]. While people-density may result in overcrowding, loss of privacy, competition for use of space and facilities and in turn create social conflicts, [25] argues that with proper management and organization, the closeness that arises from high people-density can be used to facilitate social interaction and promote good neighbourhood relations, which are characteristics of housing for resilience. High building density which can allow more open space for communal use may also help to establish social interaction and consolidate the sense of community. In the face of rapid population growth the relationship between the building density and urban form becomes crucial.

3.3.3 Adequate Services and Infrastructure Size and Distribution. As population increases so does need for infrastructure that would service the housing for the population. Such infrastructure would include, access roads, water services, sewage and waste disposal, gas distribution, (where applicable), electricity distribution and so on. While residential and other related infrastructure construction is a major source of employment, the increased city size and density provide scale economies that allow transport, communication and other essential services to be provided at lower unit cost [27]. Well-articulated infrastructure provision and distribution, in relation to the projected population growth, are essential for city resilience.

4. Research methodology

The data used in this paper is part of the data from a larger research project carried out to evaluate public housing for resilience in Abuja, Nigeria. To carry out this study, firstly, the socio-economic and environmental characteristics of housing that promote resilience to the impact of rapid population growth were identified in the review of literature. Information thus obtained formed the background knowledge to help develop 26 variables describing the possible impacts of rapid population growth in the housing estates. Using the 26 variables, a questionnaire was drawn up for residents of the selected neighbourhoods, seeking to establish perceived impact of rapid population growth on the socio-economic and environmental situations of their housing estates. The residents sampled were asked to indicate their level of agreement /disagreement with 26 statements describing the possible impacts of rapid population growth in the housing estates they lived. The questionnaire was based on a 5- point Likert type scale ranging from 1=Strongly Disagree to 5=Strongly Agree. The reliability of this scale of measurement for the 26 items was investigated using the Cronbach alpha reliability coefficient test and the result produced 0.86 (see Table 1), which is greater than the acceptable 0.70.

Secondly, in order to identify the different dimensions of the impacts of population growth on the socio-economic and environmental fabrics of the housing estates, the 26 variables investigated were subjected to factor analysis using the Statistical Package for the Social Sciences (SPSS). The suitability of the data for this analysis was examined using the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy test and the Bartlett’s Test. The value obtained for the KMO test was 0.82, which is above the acceptable value of 0.6, while the Bartlett’s Test of Sphericity was significant at .000 (See Table 2). The data were, therefore, considered suitable for factor analysis. Thereafter, the Principal Component Analysis (PCA) using Varimax Rotation method was used to identify the key dimensions of the impacts of population growth on the socio-economic and physical facets of the housing estates. The 26 variables (social, economic, and environmental), derived from the review of literature are presented in Table 3.

| Table 1: |
| Result on Cronbach’s Alpha Reliability Coefficient Test on impact of rapid population growth on socio-economic and environmental fabrics of selected housing estates |

| Reliability Statistics |
|------------------------|
|                      |
5. Results
To reveal the impacts of rapid population growth in the estates surveyed, Table 3 displays the result of descriptive statistics (mean and standard deviation) of the 26 items investigated. The result reveals that there is a difference between the mean score of residents’ level of satisfaction with the house types they occupied that met their household need when they first moved into the estate (3.77) and the extent to which the same house type still satisfies their household need at the time the survey was conducted (3.18). Secondly, with mean score of 3.59, the residents were in agreement that there is an increase in the number of people living in the estate at the time of the survey than when they first took up residence in the estates. In addition, with mean score of 3.68, the sampled residents agreed to the good distance of the estates to place of work. However, they did not agree with the views that residents in the estate trust one another (see mean score 2.84); that there are frequent disputes and misunderstanding amongst residents of the estates (2.20); that the level of crime and anti-social activities is increasing in the estates more than before (2.05); that there is ethnic segregation in the estate (2.34) and others. These results suggest that there is indeed evidence of increase in population of people living in the housing estates and this has impacted negatively on the extent in which the dwelling units are meeting the households’ needs and the level of trust amongst residents of the estates.

Table 3: Descriptive Statistics of the Impact of Rapid Population Growth on the Socio-economic and Physical Fabrics of the Housing Estates

| S/N | Statements showing the possible impacts of population growth on the socio-economic and physical aspects of the housing estates | Mean | Std. Deviation | Ranking |
|-----|-----------------------------------------------------------------------------------------------------------------|------|----------------|---------|
| 1   | The house type satisfied my household need when I first moved into the estate                                     | 3.77 | 1.14           | 1       |
| 2   | The distance to my place of work from the estate is good                                                        | 3.68 | 1.07           | 2       |
| 3   | I have witnessed a decline in the level of cleanliness of the estate since moving in here                        | 3.61 | 1.13           | 3       |
| 4   | There are more people living in the estate now than when I first moved in                                      | 3.59 | 1.06           | 4       |
| 5   | The house type still satisfies my household need today.                                                         | 3.18 | 1.27           | 5       |
| 6   | There are business opportunities within this estate                                                             | 3.16 | 1.16           | 6       |
| 7   | There is provision made for outdoor business activities within the estate                                      | 3.10 | 1.25           | 7       |
| 8   | The quality of the physical environment of the estate is declining                                            | 3.15 | 1.24           | 8       |
|   | Statement                                                                 | Mean | Standard Deviation |   |
|---|---------------------------------------------------------------------------|------|--------------------|---|
| 9 | The buildings in this estate are fast going into a state of dilapidation | 2.92 | 1.17               | 9 |
| 10| Residents in the estate trust one another                                   | 2.84 | 1.14               | 10|
| 11| The level of human and vehicular traffic is more than the carrying capacity of roads and streets in the estate | 2.83 | 1.21               | 11|
| 12| The level of noise in this estate is on the increase                        | 2.82 | 1.28               | 12|
| 13| I have more than one means of livelihood                                     | 2.78 | 1.28               | 13|
| 14| The number and sizes of refuse dumps in the estate are no longer meeting the needs of the residents | 2.68 | 1.20               | 14|
| 15| I have a regular money saving habit now than when I was living elsewhere     | 2.63 | 1.21               | 15|
| 16| The cost of living in this estate is relatively low compared to other neighbourhoods in the city | 2.58 | 1.24               | 16|
| 17| There are people living outdoors or in kiosks within our estate             | 2.56 | 1.12               | 17|
| 18| I desire to move to some other residential location in the outskirt of Abuja | 2.46 | 1.53               | 18|
| 19| There are provisions to add more rooms in my housing unit                   | 2.44 | 1.12               | 19|
| 20| The concerns for eviction from and loss of property right are on the increase in this estate | 2.37 | .90                | 20|
| 21| There is ethnic segregation in the estate                                    | 2.34 | 1.04               | 21|
| 22| There is evidence of encroachment into peoples’ property by their neighbours | 2.32 | .99                | 22|
| 23| The open spaces are being used to erect illegal structures and kiosk in this estate | 2.30 | 1.20               | 23|
| 24| There are frequent disputes and misunderstanding amongst residents of the estate | 2.20 | 1.03               | 24|
| 25| I have added more rooms to the house since I moved into the estate           | 2.08 | 1.09               | 25|
| 26| The level of crime and anti-social activities in this estate is increasing now than before | 2.05 | 1.09               | 26|

Source: Computed by the Authors, using Statistical Package for the Social Sciences (SPSS)

For the economic characteristics of the housing estates surveyed, the respondents did not agree with the statement that the cost of living in their estates was relatively low compared to other neighbourhoods in the city (2.58), nor that they have a regular money saving habit now than when they were living elsewhere (2.63). They, however, agreed that they have more than one means of livelihood (2.78). This suggests that the environment of the housing estates has negative impact on the economic life of residents in the estates.

Furthermore, environmentally, with means score of 3.61, the respondents indicated that they have witnessed a decline in the level of cleanliness of the estate since moving into the estates. Similarly, with mean score of 3.15, the result also shows that the residents agree that the quality of the physical environment of the estate was on the decline. They however, disagree that there are provisions made to add more rooms in their housing units (2.44) and that they had added more rooms to the houses since they moved into the estates (2.08). This result means that there is general decline in the levels of cleanliness and the quality of physical environment of the estates, and that the dwelling units have no provision for expansion to accommodate the changing needs of the households, even though there has been the need to do so.

5.1 Factors of the Impacts of Rapid Population Growth

The Principal Component Analysis (PCA) using Varimax Rotation method was used to identify the key dimensions (factors) for the impacts of population growth on the socio-economic and physical facets of the housing estates. Out of the 26 variables the result shows the emergence of seven dimensions with Eigenvalue of more than 1 that explained around 60.91% of the variance in the 26 items investigated in this research. From the result in Table 4 it is evident that dimension one with Eigenvalue of about 6.20 explained around 11.05% of the variance; dimension two has Eigenvalue of 3.01 and accounted for 10.50% of the variance; dimension three with Eigenvalue of 1.70 explained around 10.41% of the variance in the 26 items included in the analysis; and the fourth dimension with Eigenvalue of 1.44 accounted for 8.80% of the variance in all the variables. The remaining three
dimensions each with Eigenvalue of 1.27, 1.18 and 1.05 accounted for 8.52%, 6.17% and 5.46% variance in the 26 items investigated, respectively.

Table 4 shows the names and factor loadings for each of the seven dimensions identified, representing the various ways the impact of rapid population on the socio-economic and environmental fabrics of the housing estates was perceived by the residents.

### Table 4:
Factor Loadings of the Dimensions of Residents’ Perception of the Impact of Rapid Population Growth on the Socio-Economic and Environmental Fabrics of the Estates

| Factors                                                                 | Factor Loading |
|------------------------------------------------------------------------|----------------|
| **Factor 1:** Need for more room space, distance to work and economic situation |
| I have added more rooms to the house since I moved into the estate      | .596           |
| The distance to my place of work from the estate is good                 | .553           |
| I have a regular money saving habit now than when I was living elsewhere| .759           |
| The cost of living in this estate is relatively low compared to other neighbours in the city | .576 |
| I have more than one means of livelihood                                | .693           |
| **Factor 2:** Increase in estate population, dilapidating environment, noise |
| There are more people living in the estate now than when I first moved in | .673           |
| The buildings in this estate are fast going into a state of dilapidation | .739           |
| The level of noise in this estate is on the increase                    | .463           |
| The quality of the physical environment of the estate is declining      | .588           |
| The open spaces are being used to erect illegal structures and kiosk in this estate | .538 |
| **Factor 3:** Evidence of people living kiosks, ethnic segregation and mutual trust |
| People living outdoors or in kiosks                                    | .654           |
| Frequent disputes misunderstanding                                     | .708           |
| Perceived ethnic segregation                                            | .742           |
| Mutual trust amongst Residents                                         | .474           |
| **Factor 4:** Cleanliness and housing satisfaction                      |
| Level of cleanliness                                                    | .751           |
| Satisfaction in house type on commencement of residency                | .703           |
| Satisfaction in house type currently                                   | .600           |
| **Factor 5:** Adequacy of number and size of refuse dumps and human and vehicular traffic capacity of the estates |
| Number /sizes of refuse dumps                                           | .640           |
| Level of human / vehicular traffic                                      | .722           |
| Evidence of encroachment                                                | .637           |
| **Factor 6:** Desire to relocate, threats of crime and eviction         |
| I desire to move to some other residential location in the outskirt of Abuja | .536 |
| The level of crime and anti-social activities in this estate is increasing now than before | .760 |
| The concerns for eviction from and loss of property right are on the increase in this estate | .474 |
| **Factor 7:** Available provisions to add more rooms in housing unit    |
| There are provisions to add more rooms in my housing unit               | .748           |

Source: Computed by the Authors, using Statistical Package for the Social Sciences (SPSS)
As shown in Table 4, the first factor accounted for around 11.05% of the variance. The five variables loaded on this dimension are the need for additional bedroom spaces in the house, the distance from the estate to the place of work, the change in money saving habit, the comparative cost of living to other estates in the city and the number of streams of income. The second dimension, accounting for 10.50% of the variance, is loaded with variables such as the increase in the number of estate residents over the period of respondents’ occupation in the estate; fast rate of dilapidation of estate buildings and infrastructure; the level of noise; the quality of the physical environment and the erection of illegal structures and kiosks within the estates. The result in Table 4 also shows that the third dimension explained around 10.41% of the variance and with four variables loaded on it. The variables are increase in the number of people living outdoor (in kiosks); incidence of disputes and misunderstanding among neighbours in the estates and perceived existence of ethnic segregation in the estates; and level of mutual trust among the residents.

Furthermore, the fourth dimension explained around 8.80% of the variance and has three variables: the level of cleanliness in the estate; the satisfaction in house type at the commencement of the residency of the respondents and the satisfaction in the house type at the time of carrying out the survey loaded on it. The fifth dimension accounted for 8.52% of the variance, and is loaded with the number and sizes of refuse dumps, capacity of the estate to handle the existing level of human and vehicular traffic, and the evidence of encroachment on the estate land. In addition, the sixth dimension, accounting for 6.17% of the variance in the 26 variables, has three variables, namely, the desire of respondents to relocate to another neighbourhood in the city; the level of crime and anti-social behaviours and the threat to eviction or loss of property right. Lastly, the seventh dimension explained around 5.46% of the variance in the data, and it is loaded with one variable: there are provisions to add more rooms in my housing unit.

6. Findings and discussions
6.1 Impacts of Rapid Population Growth on Housing Estates Surveyed

The results reveal the extent to which rapid population growth has impacted on the socio-economic and environmental fabrics of the housing estates studied. They also identify the dimension of the residents’ perception of these impacts on the housing estates, and reveal their implications on housing for resilient city.

With regards to the social fabrics of the estates, rapid population growth was found to have impacted negatively on the ability of the different housing types to meet the needs of the residents over time; the levels of residents’ satisfaction in house type; having more people living in the estates than before, and on the level of trust amongst neighbours. These findings seem to support a previous study by [28] which suggested that the most immediate impact of population influx was on city’s housing, meaning that the stress of rapid population growth has usually manifested in the increasing demand for housing.

However, rapid population growth in the estates sampled is seen to impact positively on the social fabrics of the estates with regards to the distance to place of work; level of noise, crime and anti-social activities; and also on the rate of people living outdoor in kiosk; ethnic segregation and frequent disputes and misunderstanding amongst neighbours. In support of the finding of good distance to place of work, in a related study of urban design, transport and health, [29] asserted that the decision to locate housing in relation to employment, affected travel distance. This implies that the location of the estates surveyed in this study, with regards to the accessibility of the residents of the estates to their places of work, was well considered by the developers. This seeming convenience of good access to place of work could help to explain the reason behind the observed increase in the number of people living in the estates. In addition, the finding on low impact of increasing number of people living in the estates on the level of noise in the residential estates selected for this study implies that there is no problem of noise pollution in the housing estates surveyed.

Similarly, a previous study [30] it was also observed that residents were mostly not dissatisfied with the level of noise in their estates, meaning there was no problem of noise pollution in the housing estates surveyed. Contrary to this, the finding on low impact on level of noise seems to contradict finding by [31] in a study of noise levels and quality of livelihoods in residential neighbourhoods of Port Harcourt metropolis, which indicated that a high percentage of persons in residential estates were not satisfied with the noise levels in their neighbourhoods. However, in another study [32], it was established that there could be variations in the noise levels amongst different residential neighbourhoods. Similarly, the finding on low impact of rapid population growth on level of crime
and anti-social activities in the estates does not seem to agree with the studies by [33] and [34], which argued that rapid population growth leads to reduced levels of social control which might contribute to disorder and crime. The influence of social interactions on crime and safety seems to be consistent with the assertion by [35] that social interactions within a community make people feel safe and hence prove to have an effect on the risk of crime. Reference [35] further asserted that the location of housing also has an influence on the level of safety. It can be inferred from this that the strong social support identified amongst residents of the estates of the current study could be a contributing factor to the low impact on the level of crime in the housing estates.

Economically, life of the residents in the housing estates seems to be impacted negatively by rapid population growth. This finding seems to be consistent with the study by [36] indicating that population growth retards economic development in developing countries, including Nigeria. From the result of the survey, the residents indicated that cost of living was relatively high in their housing estates, compared to other residential neighbourhoods. This negative impact of rapid population growth on the economic livelihoods of the residents is possibly the reason that a high proportion (55.1%) of residents indicated that they have more than one source of income, to cushion the effects of the high cost of living in the estates. According to [37], livelihood diversification is an adaptation strategy whereby urban residents engage in multiple occupations. The finding in this survey on multiple means of livelihood seems to provide support to the argument by these authors that urban growth offers opportunity for residents to devise livelihood strategies, leading to enhancement of their wellbeing. However, [36] argued that population increase tends to lead to decline in the accumulation of capital because with increase in household size, expenses increase; and this further affects the level of saving and capital investment per household, as revealed by the results of this survey. The likely adaptation to the low economic situation in the estates is reflected in the presence of business opportunities and the provision for outdoor businesses in the estates, as revealed by the result of this survey. This suggests the presence of informal economic activities or home based businesses within the residential estates. A study by [38] and [39] provide support to the argument that one of the main manifestation of rapid population growth in a neighbourhood is the emergence of informal sector activities.

Regarding the extent of impact of rapid population growth on physical and environmental fabrics of the estates, the finding on mixed development of commercial land use with a residential neighbourhood in the estates investigated, seems to agree with [40] assessment of the paradigm shift in residential land use planning, in which a balance between residential and commercial land use is regarded as mutually beneficial. Other studies provide evidences to show that such mixture of land use is linked to creating sustainable environment, less automobile use, pedestrian-friendly environments that could promote walking and bicycling (which are characteristics of housing for resilience). However, [40] warned that the mixture of land use should not exceed a threshold level that might result to a decrease in residential land value.

Furthermore, the result shows that rapid population growth seems to have impacted negatively on the declining quality of physical environment; the fast rate of dilapidation of buildings; the decline in level of cleanliness of the estates; the number and sizes of refuse dumps meeting the needs of the residents, and the level of human and vehicular traffic being more than the carrying capacity of roads and streets in the estates. However, it was observed that there was a positive impact of rapid population growth on concerns for eviction; evidence of encroachment on peoples’ property and the use of open space for illegal structures. With regards to declining quality of physical environment and fast rate of dilapidation of building in the housing estates, the result reveals that the house types satisfied the household needs when the respondents first moved into the estates, but over time the level at which house types satisfied household needs had dropped. This is evident in a greater proportion (79.7%) of the respondents expressing desire to add more rooms to their houses, thus suggesting an increase in the household population, and subsequent stretch on the existing infrastructural facilities in the estates.

6.2 Dimensions of Impact of Rapid Population Growth

With regards to dimensions by which the sample residents perceive the impacts of rapid population growth on their estates, the seven key factors identified in this study are:

(i) The need for more room space, distance to work and economic situation of the residents
(ii) Increase in estate population, dilapidating environment and level of noise in the estates
(iii) Evidence of people living in kiosks, ethnic segregation and mutual trust amongst residents
(iv) Cleanliness and housing satisfaction
6.3 Implications of the dimensions to city resilience

The implication of this result on housing for resilience is drawn from study by [41] which identified five key factors that influence housing resilience and housing adaptation to stress as: (i) additional living space, modified access ways, privacy, access to light and air circulation (ii) a variety of construction methods and materials (iii) incremental process of transformation (iv) physical private/public boundaries are fluid, reflecting flexibility (v) housing and wider circulation space are defined by their multi functionality. Relating the finding of the current study to that of [41], therefore, it is observed that only two of the seven dimensions of residents’ perception of impact of rapid population growth on the estates in the current study are mentioned among the factors that influence housing resilience and housing adaptation to stress as identified by [41]. However, these two dimensions are revealed to be impacted negatively by rapid population growth in the estates. The two dimensions are dimension one: the need for more room space, distance to work and economic situation of the residents; and dimension two: increase in estate population, dilapidating environment and level of noise in the estates. This means that it is required that factors of additional living space, modified access ways, privacy, as well as incremental process of transformation should be present to influence housing resilience and housing adaptation to stress. However, the two dimensions of impact of rapid population growth in the current study reveal otherwise. From the current study, there are no provisions made for additional living space, and the dilapidating environmental condition does not show an incremental process of transformation. Also, the other five dimensions of impacts of rapid population growth of the surveyed estates as perceived by the sampled residents are, by this reference, not considered as factors that influence housing resilience and housing adaptation to stress as the study by [41] portrays.

7. Conclusion

The vulnerability of residential neighbourhoods to the impacts of rapid population growth was found to be a function of social, economic and environmental features of housing. The findings of the study show that the factors of housing affected by the impact of rapid population growth include the need for provisions for expansion of dwelling units to accommodate population increase, considerations of the distance from the estate to the place of work, sustainable money saving habits, the comparative cost of living, as well as the number of streams of income of prospective tenants. However, the results reveal that the public housing estates surveyed do not positively reflect some of these factors, are most likely not adaptable to the stress of increasing population, and therefore not resilient to rapid population growth. This study implies that for public housing schemes in developing countries like Nigeria to influence city resilience, housing designers and developers should consider these factors together with consideration of the use of a variety of construction methods and materials, incremental process of transformation, multi functionality and flexibility of use of space. This measure is intended to help in reducing the adverse effects of urbanisation on housing and to promote resilience in cities of developing countries.
Reference

[1] Yanez, K. (2012). In *Visions of a resilient city*. Resilient City Scoping Study. ARUP International Development. ARUP and Engineers without Borders-UK. London, UK.

[2] Seeliger, L., & Turok, I. (2013). Towards sustainable cities: Extending resilience with insights from vulnerability and transition theory. *Sustainability*, 5, 2108-2128.

[3] Oduwayne, L., & Abdul-rahman, M. (2018). Planning for urban resilience in Nigeria. Researchgate.com

[4] Brisibe, W. G. (2018). Assessing architects’ knowledge of flood resilient and adaptable buildings in Yenagoa, Nigeria. *Journal of Architecture and Construction, 1* (2), 16 - 24.

[5] Field, C., Look, R., & Lindsay, T. (2016). Resilience insight: Twelve city assessment summary. *Burohappold Engineering*, 1-12.

[6] Resilient City Housing Initiative (RCHI) (2013). Planning practices that matter: Housing for resilient cities. MIT Department of Urban Studies and Planning.

[7] Vale, L. J., Shamsuddin, S., Gray, A., & Bertumen, K. (2014). What affordable housing should afford: Housing for resilient cities. *Citiescape, 16* (2), 21-50.

[8] Andrews, J. (2015, February 15). *What makes a city resilient?* Retrieved October 17, 2017, from Cities Today: http://www.cities-today.com.

[9] Abubakar, I. R. (2014). Abuja city profile. *Cities*, 41, 81-91.

[10] Population City Estimate, 2016. Abuja Population. www.population.city. Accessed on July 18, 2018.

[11] World Bank (2017). *Our commitment to action on climate change*. http://www.worldbank.org/en/news/press-release/2017/06/01.

[12] Grosvenor Research Report. (2014). *Resilient Cities: A Grosvenor research report*. New York: Grosvenor Group Limited.

[13] Thornley, L., Ball, J., Signal, L., Lawson-Te Aho, K., & Rawson, E. (2015, August 08). Building community resilience: Learning from the Canterbury earthquakes. *Kotuitui: New Zealand Journal of Social Sciences Online, 10*(1), 23-35.

[14] Carpenter, A. (2013). Social ties, space and resilience: Literature review of community resilience to disasters and constituent social and built environment factors. Federal Reserve Bank of Atlanta.

[15] Pollack, C., Green, H., Kennedy, D., & Griffin, B. (2014). The impact of public housing on social networks: A natural experiment. *American Journal of Public Health, 104* (9).

[16] Kenton, W. (2014). *How social resilience can save your city*. Retrieved from http://www.100resilientcities.org.

[17] Nussbaum, M. C. (2013). *Political emotions: Why love matters for justice*. Cambridge, Massachusetts: The Belknap Press of Harvard University Press.

[18] Krantz, L. (2001). The sustainable livelihood approach to poverty reduction: An introduction. Stockholm, Sweden: Swedish International Development Cooperation Agency (SIDA).

[19] Kihato, C. (2007). African urbanism. In R. Burdett, & D. Sudjic, *The Endless City* (pp. 214-217). New York : Phaidon Press Limited.

[20] Yunusa, M. B. (2005). Life in a high density urban area: Anguwar Mai Gwado in Zaria. In A. Simone, & A. Abouhani, *Urban Africa: Changing Contours of Survival in the City* (pp. 177-205). London: Zed Books.

[21] Agbola, T., & Adegoke, S. A. (2007). Economics of housing. In T. Agbola, L. Egunjobi, & C. Olatubara (Eds.), *Housing Development and Management: A Book of Readings* (pp. 107-149). Nigeria: Department of Urban and Regional Planning, Faculty of Social Sciences, 2of Ibadan. University of Ibadan Press.
[22] Agbola, T., Nwokoro, I., & Kassim, F. F. (2007). Housing and Health. In T. Agbola, L. Egunjobi, & C. Olatubara (Eds.), Housing Development and Management: A Book of Readings (pp. 499-537). Nigeria: Department of Urban and Regional Planning, Faculty of Social Sciences, University of Ibadan. University of Ibadan Press.

[23] Simone, A. (2005). Introduction: Urban processes and change. In A. Simone, & A. Abouhani, Urban Africa: Changing Contours of Survival in the City (pp. 1 - 26). London: Zed Books Limited.

[24] Oluurin, T. (2007). Residential land use planning. In T. Agbola, L. Egunjobi, & C. Olatubara (Eds.), Housing Development and Management: A Book of Readings, 568-605. Nigeria: Department of Urban and Regional Planning, Faculty of Social Sciences, University of Ibadan.

[25] Cheng, V. (2010). Understanding density and high density. In E. Ng, Designing High-Density Cities for Social and Environmental Sustainability (pp. 3-18). London: Earthscan.

[26] Power, A. (2007). At home in the city. In D. S. Ricky Burdett, The Endless City (pp. 364-371). New York: London: Phaidon Press Limited.

[27] Mason, A. (1996). Population, housing, and the economy. In D. A. Ahlburg, A. C. Kelley, & K. O. Mason, The Impact of Population Growth on Well-being in Developing Countries (pp. 175-218). New York, Springer.

[28] Potter, J., Cantarero, R., Yan, X. W., Larrick, S., & Ramirez-Salazar, B. (2004). A case study of the impact of population influx on a small community in Nebraska. Great Plains Research: A Journal of Natural and Social Sciences, 14 (2), 219 - 230.

[29] Giles-Corti, B., Vernez-Moudon, A., Reis, R., Turrel, G., Dannenberg, A., Badland, H.,.... Owen, N. (2016). City planning and population health: A global challenge. Urban Design, Transport, and Health 1, 388, 2912 - 2924.

[30] Babalola, O. D., Iben, E. O., Olotuah, A. O., & Fulani, O. A. (2016). Resident perception of quality of public housing in Lagos, Nigeria. International Journal of Applied Environmental Science, 11 (2), 583 - 598.

[31] Emenike, G. C., & Sampson, A. P. (2017). Noise levels and quality of livelihoods in residential neighbourhoods of Port Harcourt metropolis, Nigeria. European Journal of Earth and Environment, 4 (1), 19 -28.

[32] King, G., Roland-Mieszkowski, M., Jason, T., & Rainham, D. G. (2012). Noise levels associated with urban land use. Journal of Urban Health, 86 (6), 1017 - 1030.

[33] Ruddel, R., & Ortiz, N. R. (2014). Boomtown blues: Long term community perceptions of crime and disorder. American Journal of Criminal Justice, 40 (1) . doi:https://doi.org/10.1080/1177083X.2014.934846

[34] Kranich, R.,S. (2012). Social change in natural resource-based communities: The evolution of sociological research and knowledge as influenced by William R. Freudenburg. Journal Of Environmental Studies and Science, 2 (1), 18-27.

[35] Mohit, M. A., & Elsawahi, H. M. (2017). Crime and housing in Kuala Lumpur: Taman Melati terrace housing. Asian Journal of Environment Behaviour Studies, 2 (2), 53 - 63.

[36] Adewole, A. O. (2012). Effect of population on economic development in Nigeria: A quantitative Assessment. International Journal of Physical and Social Sciences, 2 (5), 1-14.

[37] Odoro, C. Y., Adamtey, R., & Ocloo, K. (2015). Urban growth and livelihood transformations on the fringes of African cities: A case study of changing livelihoods in peri-urban Accra. Environment and Natural Resources Research, 5 (2), 81 - 98.

[38] Ezeadiche, N. (2012). Home-based enterprises in urban spaces: An obligation for strategic planning. Berkeley Planning Journal, 25 (1), 44 - 63.

[39] Adeokun, C. O., & Iben, E. O. (2016). Home-based enterprises: Implications for housing and urban planning in Nigeria. Journal of Architectural and Planning Research, 33 (1), 71-89.

[40] Yang, H. J., Song, J., & Choi, M. J. (2016). Measuring the externality effects of commercial land use on residential land value: A case study of Seoul. Sustainability, 8 (432), 3 - 15.
[41] Jones, P. (2017). Housing resilience and the informal city. *Journal of Regional and City Planning*, 28 (2), 129-139.